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Mound versus Village: A Biocultural Investigation of Status and Health at the Cox Site

Juliette R. Vogel
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To the Graduate Council:

I am submitting herewith a thesis written by Juliette R. Vogel entitled "Mound versus Village: A Biocultural Investigation of Status and Health at the Cox Site." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Murray K. Marks, Major Professor

We have read this thesis and recommend its acceptance:

David G. Anderson, Lynne P. Sullivan

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Mound versus Village:

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A Thesis
Presented for the
Master of Arts Degree
The University of Tennessee, Knoxville

Juliette R. Vogel
August 2007

DEDICATION

I dedicate this thesis to my family, whose steady source of encouragement has been the true source of any academic accomplishment I have ever attained.

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While conducting my analysis at McClung Museum, I had the fortune of working alongside Maria Smith, who kindly answered any questions I had regarding skeletal pathologies. Her talent for paleopathological research and familiarity with the McClung skeletal collections continues to amaze me.

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Finally, this acknowledgment would be incomplete without mentioning the wonderful friends I have made here in Knoxville. You all have provided me with enough fun and insanity to last several lifetimes! I believe the camaraderie we share has allowed us all to survive graduate school.

ABSTRACT

A good deal of what we know regarding the prehistoric Mississippian period (1000-1600 AD) in the Southeastern United States has been provided for by mortuary studies. Archaeological investigations have uncovered what appears to be differential treatment in burial practices among some subsets of community populations. The argument has been made that those individuals buried in ceremonial mounds or interred with finely crafted or exotic grave goods make up the "elite" sector of a population while those with less spectacular burial treatment are "commoners."

The purpose of this research is to determine if health status differs by burial location at the Late Mississippian Cox site of Anderson County, Tennessee. The site consists of one mound and an associated village. This study does not assume social rank is associated with burial location, but instead adopts a biocultural perspective to ascertain if differences in health status by burial location suggest possible differences in social status.

A skeletal sample of 230 individuals was analyzed. Thirty-nine individuals were exhumed from the mound and 191 from the village. Sex, age, and health status were evaluated for each individual. Health status was determined by observing porotic hyperostosis, cribra orbitalia, dental disease, infectious disease, and linear enamel hypoplasias. An overall health score based on these characteristics was then calculated for each individual. Logistic regression as well as chi-square analyses were performed to determine any correlation between health status and burial location.

There was no statistically significant difference between burial locations as they related to overall health status. Porotic hyperostosis was the only pathology to differ significantly by burial location (p=0.0005). Dental disease, infection, and linear enamel hypoplasias affected both mound and village samples similarly. Possible evidence for the presence of both tuberculosis and treponematosis among the site's occupants was noted. A logistic regression of health score indicated that at any given age, if an individual exhibits one less pathology, he or she is 1.5 times more likely to be buried in the mound. However, social inequality in this late prehistoric community is not supported by any findings of biological inequality.

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CHAPTER ONE: INTRODUCTION

One of the many avenues to understanding human variation lies in studying how human beings respond to environmental stressors. Examining the body's intricate and well-orchestrated responses to external forces, harmful or beneficial, is no small task. However, it is a necessary one to undertake in order to understand the range of variability in human populations.

One of the most important environmental stressors we face every day happens to be our very own culture. Our bodies are products of our individual social histories. Consider, for instance, the current problem of inadequate healthcare in America. With luck, an individual might be able to eke out a living by working a minimum-wage job, but chances are he or she is not afforded a decent health insurance plan. This is not good, as the individual will more than likely end up suffering from heart disease after a lifetime of consuming a steady diet of fatty and sugary foods afforded by such a meager salary. The less fortunate continue to be slighted while the upper classes have access to the best healthcare services money can afford. And the problem is not confined to the United States. One must not forget the misery and death wrought by such diseases as AIDS and extensively drug-resistant tuberculosis in some of the poorest countries in the world (namely those in Africa) while more privileged nations emerge well-equipped, with far fewer lives claimed.

Why do some appear to suffer so much and others so little? The key to answering this pressing question is understanding who in any given society has access to resources and why. To put it simply, "money talks." And it appears to have been this way in countless cultures over thousands of years (Diamond 1999). Our bodies will likely bear the marks of any inequality present in our society.

This paper will offer a case-study of this issue by examining a late prehistoric Native American skeletal sample (from the Late Mississippian-era/Dallas phase Cox village and mound, site 40AN19, Anderson County, TN), ascertaining any health consequences of such differential treatment. Differential treatment is measured here by burial location. Yet, it is important to note here that differing burial locations do not imply inequality. This study is not begun with an a priori assumption that individuals buried in certain locations were buried that way because of different social statuses. In fact, the purpose of this study is to discover if there *are* social inequalities that might be implied by any biological inequalities correlating with burial placement.

Tracing social inequality in a prehistoric society presents a difficult task, but one worth undertaking. And what better discipline with which to engage it but the holistic one of anthropology? It can contribute to our growing knowledge regarding the manner in which human cultures operate and what impact that has on human survival. It will be interesting to discover any characteristics of this late prehistoric society that might mirror our own or others.

Further Benefits of Paleopathological Research

In addition to investigating possible inequalities in or characteristics of a past society, paleopathological research is essential in understanding human diversity, as departures from what we deem healthy may indicate the historical depth of some of the conditions we still face. For example, through the study of mummified as well as skeletal remains, it has been shown that tuberculosis is an ailment with considerable time depth

(Roberts and Buikstra 2003). In addition, consulting modern clinical literature can give one insight as to how some physical misfortunes may have affected the individuals they victimized. How may daily aspects of human life, such as mobility and productivity, have been affected? Within certain communities, were some individuals healthier than others? Studying skeletal and dental pathology in past populations can give one insight with respect to how certain maladies affected community life and how the community, in turn, might have responded.

Paleopathology can also reveal possible trends regarding human co-adaptation with disease (Diamond 1992; Thornton 1987). Were certain environments conducive to disease transmission? How did this affect individual fitness? Did exposure to particular diseases cause populations to build up a resistance to them? Finally, the study of diseases in the past can aid in understanding present global epidemiology.

Study Aims

This research provides an intrapopulation case study of health status at the late prehistoric Cox site in east Tennessee (Anderson County, 40AN19) (Figure 1). This Late Mississippian site consists of a ceremonial mound and associated village, both of which contain burials. The primary focus of this study is to ascertain possible health differences between individuals with respect to burial location. The questions this research will answer are as follows:

1.) Do individuals buried in the mound exhibit lower rates of pathology when compared to individuals buried in the village, or vice versa? Is there any statistically significant difference at all? Do pathology rates reveal anything regarding differential health based on rank or status?

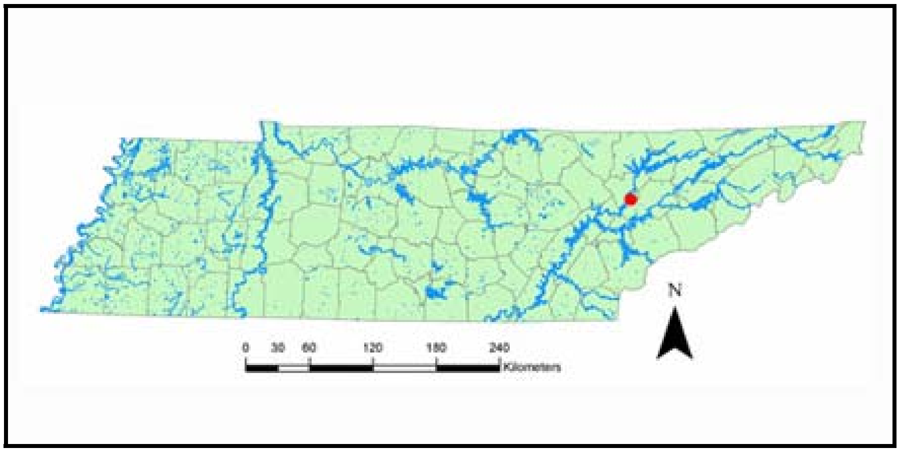

Figure 1: Location of the Cox Site (40AN19), Anderson County, TN. Image courtesy of Bobby R. Braly.

2.) Is there a preferential burial location for certain groups based on age and/or sex?

3.) What do the incidences of pathology reveal regarding quality of life? How may fertility, mobility, and productivity have been affected by the disease experience?

4.) What prehistoric and historic evidence is there for the inhabitants' adaptation to certain pathological conditions? How can these results be placed within a larger epidemiological context?

5.) Finally, how do these results compare regionally to other east Tennessee Mississippian sites and to the larger Southeast?

CHAPTER TWO: LITERATURE REVIEW

Any good bioarchaeological analysis requires a careful consideration of the society from which a skeletal sample derives. Otherwise, all that would result is a one-dimensional, "bare bones" report. That is why, before delving into a discussion on health and how it relates to social rank, it is paramount to review the sociological and archaeological literature regarding ranked societies.

Origins of Ranked Societies

In order to examine the importance of rank in any given society, one must first consider possible reasons why ranked societies emerge. This area of research is not without considerable debate. James Brown (1981) summarizes certain approaches to why rank originated, noting that it had long been the view of many archaeologists (Cancian 1976; Childe 1936) that inequality emerged as a result of "surplus above subsistence needs, thus necessitating chiefly control of resources" (Brown 1981:26). However, other scholars assert that it was likely the other way around. That is, chiefly leadership results in surplus resources (Flannery 1972; Rappaport 1971; Sahlins 1972). Furthermore, there are two theories detailing exactly how this happens: circumscription theory and managerial theory. With circumscription theory, Carneiro (1970) puts forth that groups eventually gain access to certain resources and that access is handed down hereditarily. Service (1975) and Wright (1977) argue for managerial theory by stating that rank results when a leader must take control of resource distribution and security. This leader is then likely endowed with ritual authority and has no need to coerce subordinates into submission (Brown 1981). Charles Cobb provides an excellent summary of this type of societal organization:

> Mississippian polities apparently engaged in a variety of hegemonic practices where people willingly reproduced the conditions of their own exploitation. In this sense, even exploitation may be a misnomer if producers were willing to provision elites because those leaders were viewed as essential to the stability of the natural order by virtue of their esoteric knowledge and authority [Cobb 2003:78].

Paynter (1989) also believes the "inequality before surplus" (376) argument is well-evidenced in archaeological research. He devotes an entire journal article to ideas regarding the origins of inequality and which of these show the most promise. For those subscribing to neoevolutionary thought, complex society is supposed to solve problems as groups become more sedentary, population growth is fostered, and competition for resources results. This ultimately leads to division of labor and social boundaries (Paynter 1989:374). Paynter exposes a weakness in this "problem-solving" argument, however, by noting that Cohen (1985:113) states "participation in large political units generally had a negative impact on health, except for those in privileged groups."

More convincing theories of inequality's origins have surfaced with the advent of post-modern/post-processual studies. Introducing concepts such as agency and gender relations have led to a more comprehensive view of hierarchy. One important post-modern concept is that of structuration (Giddens 1984). This is the notion that we are all deeply embedded in our own particular social histories, an idea espoused by such popular sociological scholars as Marx, Bourdieu, and Foucault. In order for leaders to assume power, they must legitimate their authority by manipulating the past to their advantage. Historically meaningful objects, symbols, or rituals are used as a leader's tools to gain the trust of the masses. This use of the past, of course, does not mean that the leader is not also as historically rooted in these systems of meaning as are his or her "subordinates."

Rather, it is not likely they are always *consciously* using the past to their advantage (Robb 1998:335). However, in the case of some callous fascists, unintentional use of the past could be disputed. Furthermore, we must not forget the fact that Charles Manson gained a considerable following when he told people he was the reincarnation of Jesus (Bugliosi 1974).

Paynter (1989) discusses one idea of hierarchy that appears to be particularly well-argued: Johnson's (1978, 1982, 1983) model of egalitarian hierarchies. The term "egalitarian hierarchy" seems at first to be an oxymoron, but Paynter describes it well:

> [Johnson] distinguishes between simultaneous and sequential hierarchies. Simultaneous hierarchies are stable, organized around a single set of people. Kings sit at the top of simultaneous hierarchies. Sequential hierarchies are ephemeral, their membership in flux. Big-men sit atop sequential hierarchies… As long as access to the full range of strategic resources is not restricted to a single position in any hierarchy and access to these positions continually changes, no structural monopolization can develop… One way inequality might develop is through the transformation of sequential hierarchies into simultaneous hierarchies. The appropriate social conditions, say competition for positions at the tops of sequential hierarchies or resistance by hierarchy members to entreaties for additional surplus, might impel a sequential hierarchy leader to acquire the leadership of additional sequential hierarchies, ultimately seeking to gain a monopoly over all the hierarchies of accumulation. As more and more positions come under a leader's sway, the numerous sequential hierarchies would come to look more like a simultaneous hierarchy centered on the leader [Paynter 1989:382].

The majority of Mississippian archaeologists would likely view such major chiefdoms as Cahokia, Moundville, and Etowah to be of this particular order. Settlement studies suggest that peripheral villages participated in extensive trade networks (Earle 1991; Goad 1978; Meyers 2006; Peregrine 1992; Phillips and Brown 1978; Walthall

1981) and often indirectly supplied core chiefdoms with the traded goods (Steponaitis 1978, 1986). However, it is likely the regional chiefdom only directly reigned over a relatively small area (Scarry 1996).

In his synthesis of fifteen years of research in southeastern archaeology, Steponaitis (1986) mentions that inequality may have risen as individuals acquired more and more prestige items (especially exotic imports) and agriculture intensified. However, in this publication, he intimates that agricultural surplus arrived before hierarchy (1986:392).

It appears that the order in which surplus and inequality arrive is still an area of contention. Some scholars still tenaciously cling to the theory of surplus before inequality. One such notable scholar is Jared Diamond. Although his training is in human biology and not anthropology, he holds that groups of people who were successful at agriculture were able to develop their communities in other ways (Diamond 1999). Building upon the work of Childe (1936), his book *Guns, Germs, and Steel* (1999) has popularized the notion that when human energy no longer had to be directed toward maintaining a steady supply of food, individuals could focus on other activities, like craft specialization. His core argument is that this specialization led to a head-start in technology among these agriculturally successful societies and they ultimately obtained an advantage over less technologically skilled cultures, subsequently conquering them and labeling them subordinates. Diamond’s argument has its critics, namely those who disapprove of its simplicity and ecological determinism (Peregrine and Lekson 2006). In explaining the origins of inequality, too much emphasis is placed on geography (leading to agricultural success, technological achievements, and ultimately inequality) and not enough on the complex cultural processes that help shape ranking systems.

What is highly interesting is the fact that chiefdoms appear to go through cycles of rising and falling, a process Anderson calls “cycling” (1990, 1994) and Blitz calls “fission-fusion” (1997). These centers of control eventually collapse after political instability, warfare, and ecological change become too much to bear. Furthermore, settlements at the periphery of a chiefdom’s control are likely more autonomous than those at the core (Steponaitis 1986). Therefore, allegiance appears to be continually redefined. Cobb (2003) notes that “even the most impressive chiefdoms apparently lasted in the range of only 50 to 100 years.” The archaeological record suggests that Moundville was slowly depopulated and used instead as a necropolis (Cobb 2003; Hally 1996; King 2001; Pauketat 1997; Steponaitis 1988). Some suggest this may be related to power becoming more centralized in individuals versus communities (Anderson 1999; Trubitt 2000).

Mississippian Settlement Patterns

Chiefs not only legitimate their authority by manipulating the past but by also manipulating space. Landscapes are a highly useful tool to shock and awe. Anyone who has ever seen Stonehenge, the Egyptian pyramids, the French châteaux of the Loire Valley, New York skyscrapers, or any other type of monumental architecture can attest to this. The large mounds of earth to which higher-ranking individuals had access were impressive structures built to elevate them both spiritually and politically. That is, while being closer to their gods (Knight Jr 1986), they could also remind non-elites who was in control (Cobb 2003; Kus 1982, 1983; Pauketat 1997; Wesson 1998). Furthermore, the mound served as a sort of “panopticon.” The idea of panopticism (“seeing all”) was developed by Foucault (1984) in response to what one architect devised as the perfect plan for a prison. The plan was conceived of as a way for those in power (prison guards) inhabiting a central structure to always keep their eye on subordinates (inmates); therefore, inmates had no choice but to behave themselves. Marcoux (2003) realized this big-brother plan appeared to work for Mississippian mound centers as well. The GIS data he collected at Moundville proves that surveillance of the environs from atop the mound was entirely possible and was likely a useful tool to keep non-elites in check.

This “spatial asymmetry” (Cobb 2003:69) can also be seen within larger regional contexts. Steponaitis describes the typical layout:

> Most Mississippi-period communities were linked by political, economic, and social ties into larger regional polities. These polities varied greatly in size and complexity, both across space and through time. At one end of the scale were relatively simple chiefdoms— each a small, relatively autonomous political unit consisting of a single center and its immediate hinterland. At the other extreme were larger, more centralized polities with two levels of chiefly authority, indicated archaeologically by two levels of centers [Steponaitis 1986:391].

Therefore, large polities were organized into the “core” and “periphery.” It appears that most studies focus on the effect the core has on the periphery and not the other way around (Meyers 2006). Some recent research has been devoted to the periphery (Lambert 1999; Maxham 2000; Welch 2006), but according to Meyers (2006), not enough. Her central question centers around the impact peripheral prestige items (like salt and copper) have on core chiefdoms. Her research suggests that leaders of peripheral chiefdoms pulled considerable weight in controlling resources and that those with an administrative center at the core of the community enjoyed the greatest success in controlling trade items. Her argument as it relates to the peripheral chiefdom in which the Cox site is located will be addressed in further detail in discussion of results.

Mortuary Archaeology and Rank in Mississippian Societies

Archaeologists working in the Southeast typically make the assumption that the higher-ranking individuals in a Mississippian society are buried within platform mounds and lower-ranking individuals are buried in the non-mound or village location (but see Sullivan 2001, 2006; Sullivan and Rodning 2001). This assumption is based on an archaeological correlate of ranked societies proposed by several pioneers in the study of the social dimensions of mortuary practices (Binford 1971; Brown 1971; Larson 1971; O'Shea 1981; Peebles 1971). In essence, certain individuals receive different mortuary treatments, which correlates positively with rank and which can be seen primarily in energy expenditure on burials (Peebles and Kus 1977; Tainter 1978). The idea that rank correlates with burial location is supported by the tendency for individuals buried in mounds to be given more elaborate mortuary treatment than individuals buried in villages (Hatch 1974; Scott and Polhemus 1987).

Peebles and Kus (1977) use an ethnographic case to illustrate a ranked society. Native Hawaiians of lower rank supply their chief and high-ranking individuals close to him with resources so that he may appease the major deities they worship. In defining archaeological correlates of ranked societies, Peebles and Kus first focus on mortuary archaeology. They propose that there should be a "superordinate" group of individuals represented in burials who are ranked based on genealogy, irrespective of age or sex. The presence of such a group suggests ascribed rank, as young children who have not had a chance to achieve high rank have already obtained it. In this group, funerary objects and energy expenditure on mortuary treatments will not differ for individuals based on age and sex. Second, there should be a "subordinate" group that is ranked based on achievement. This ranking, in contrast to the superordinate group, also is based on age and sex. Thus, funerary artifacts as well as energy expenditure will differ among different age and sex groups. Ranked societies differ in degree of differentiation among ranks and can often include both achieved and ascribed avenues of acquiring power. One case in point is seen at the Toqua site in the Little Tennessee River Valley of eastern Tennessee (Scott and Polhemus 1987).

A distinction is also made between "vertical" and "horizontal" differentiation (Peebles and Kus 1977). Vertical differentiation (often hereditary) can be viewed as pyramidal in structure, with privileged elite at the apex and commoners at the base. Horizontal social positions, on the other hand, consist of clan or sodality memberships. According to O'Shea (1981, 1984), vertical distinctions are often characterized by non-perishable artifacts, but if some ranks are not visible archaeologically because the status markers were made of perishable materials, it is still possible to discern and interpret social ranking in the society as a whole. In contrast, horizontal differentiation involves all society members and if membership in some of these social categories is denoted by perishable items, the analyst cannot be sure that horizontal differention is being symbolized because some individuals will have no archaeologically visible status markers.

A number of studies have surfaced critiquing these processual approaches to mortuary interpretation. In the landmark publication *The Archaeology of Death* (Chapman et al. 1981), several researchers contribute to the notion that the quality and abundance of grave goods does not directly correlate with status. In their introductory chapter, Chapman and Randsborg identify several problems related to mortuary studies that their volume will address. They expand upon the fact that burial energy expenditure and spans of cemetery usage are difficult to measure as well as the fact that research and historical evidence indicate that there is considerable cross-cultural variation in interment rituals. Regarding cemetery spatial arrangements, Chapman and Randsborg note,

> Little attention has been given to cemeteries which remain in use over generations, if not centuries: what is the nature of the changing relationship between the availability of space within the cemetery and the decisions taken by the living community about the form and location of interment of different age, sex and status groups? Indeed by such decisions the community may or may not choose to reflect social affiliation or status through the spatial dimension [Chapman and Randsborg 1981: 15].

Additionally, with respect to funerary artifacts, Chapman and Randsborg (1981:9) state, "Tainter has published results of a cross-cultural survey which show that less than 5% of a sample of 93 societies used grave goods to symbolize status differences (1978:121)." Further inconsistencies in widely-held assumptions of mortuary archaeology can be demonstrated by several examples:

1.) Saudi Arabian kings are not given preferential treatment in burial. They are buried under stone piles similar to everyone else as Islamic values hold that everyone is equal in death (Huntington and Metcalf 1979).
2.) Greece and Rome attempted to enact laws limiting funerary energy expenditure (Kurtz and Boardman 1971; Toynbee 1971).

3.) Parker Pearson (1982) documented expenses of funerals for the year 1977 in Cambridge and found that the most elaborate and expensive funerals were conducted by gypsies, members of the lowest class.

4.) Children with no hereditary rank are sometimes buried with adult grave goods. This is seen in the Tiwi hunter-gatherers off the coast of Australia (Goodale 1971; Hart and Pilling 1966) and in England (Jupp 1993).

5.) Funerary artifacts have different meanings across cultures (Goldstein 1981; Ucko 1969). For example, the Lugbara of Ghana place in the tomb items symbolic of the groups of which an individual was a part (i.e., for a woman, beads represented her as a girl, firestones indicated she was a wife, and grinding stones meant she was a mother) while the LoDagaa of Ghana place a small amount of offerings in the tomb to accompany the individual (of any age or sex) in the afterlife (Ucko 1969). Thus, both groups are geographically close but differ in their view of the relationship between tomb and afterlife.

Critiques of processual archaeology center on its tendency to search for cultural universals as well as downplay the thoughts and motivations of individuals, treating them instead as passive subjects who are at the mercy of ecological and political evolutionary forces. Leach (1979:122) states, “If graves are in any way an index of social status it is the social status of the funeral organizers as much as the social status of the deceased that is involved.” As can be seen with Parker Pearson’s (1982) observations of gypsies, this statement is very true. Much criticism was directed toward James Brown, the editor of *Approaches to the Social Dimensions of Mortuary Practices* (1971). Brown received the criticism well and stated that the volume no doubt needed to be revised (Chapman 2003). Indeed, Brown later stated,

> The elaborate treatment of children [is not] an indication simply of the inheritance of power or authority in a society… There is a methodological weakness in effort-expenditure measures. There is no certainty as to the reliability of a scale of effort expenditure that includes different material expressions [Brown 1981:29].

In 2006, Brown considered a dramatically different interpretation of the burials from Cahokia's Submound 1 (Mound 72). He argues that a group of individuals buried here were secondarily interred for the purposes of enacting a ritual myth. Instead of interpreting status with the funerary artifacts of each individual, he focuses instead upon the arrangement of the burials and associated artifacts in a collective manner.

The presence and type of funerary artifacts in burials have provided measures of status for quite some time and still motivate much Mississippian research today (Cobb 2003:72). However, burial placement is another important variable to consider when analyzing status. As previously mentioned, burials associated with platform mounds are considered by many Southeastern archaeologists to be elite (Hatch 1974; Scott and Polhemus 1987). One critique of this (quoted previously) is put forth by Chapman and Randsborg (1981): How is one to discern multi-generational use of a cemetery? It is entirely possible that people simply ran out of space and started interring the deceased in areas where there was room. What if Cox village inhabitants, the focus of this study, ran out of room for burials on top of the mound and just began burying individuals around and then eventually further outside the mound area? Perhaps archaeologists are trying to read too much into burial patterns when the explanation for their arrangement can actually be quite simple.

Burial location demographics are another important aspect of Mississippian mortuary ritual to consider. Lynne Sullivan has focused much attention upon the issue of gender in Mississippian societies (Sullivan 2001, 2006; Sullivan and Rodning 2001). She argues that it is a Eurocentric assumption that men were hierarchically superior to women only because they make up the majority of platform mound burials. It is likely that American Indian societies do not construct gender roles and relationships in the same ways as European societies. Sullivan advocates "heterarchy" (Crumley 1995), or the idea that power can be held in not just one context, but many. Sullivan contends that men were buried in mounds because they exercised power in the public, political sphere (which European ideology and tradition places more importance upon) and women were buried in the village because they wielded power in the domestic sphere. She uses two east Tennessee Dallas Phase (Late Mississippian: A.D. 1300-1600) mound sites to support her argument (Sullivan 2006). Mound demographics for both sites, Dallas and Toqua, are remarkably similar in that young adult males make up the majority of mound burials. Sullivan contends that these young men are buried there because they have acquired warrior status. However, when taking into account the demographics of the entire skeletal samples for each site, young adult males make up less than 25% of the sample at Dallas while young adult males make up more than 50% of the sample at Toqua. Sullivan interprets this as it relates to opportunities to obtain warrior status. If warfare is low and there are not enough opportunities for young men to participate in warfare, then chances are many of them will not contribute greatly to the skeletal sample. They have the opportunity to grow older and enter new age cohorts (likely being buried later on as older men). It appears that young men at Toqua had more opportunities than

Dallas males to gain warrior status, as there are greater frequencies of their age cohort represented in the skeletal sample. Furthermore, disparate burial locations for males (mound) and females (village) are greater at Toqua than they are at Dallas. Sullivan suggests (in light of ethnohistorical accounts of Cherokee women having the power to decide whether or not men go to war) this may be because domestic and political power relations may have been more polarized due to higher incidences of warfare. Sullivan (2006:266) states, "The domestic power sphere and the public power sphere can juxtapose themselves to create a system of checks and balances for the other." If at Toqua these spheres were more often juxtaposed and thus polarized, then it would make sense that individuals associated with each would be placed in different contexts. According to Sullivan, it is likely that the Dallas site does not evidence such sharply distinct burial patterns for each sex because warfare was not as pressing a concern for each power sphere as it was at Toqua.

Sullivan's (2006) explanation of asymmetrical burial patterns for males and females derives its strength from bioarchaeological analysis. Without an analysis of each individual's sex and age, her argument would be impossible. Bioarchaeological analysis also has the ability to detect patterns of health. By assigning individuals a health status, one can detect whether or not burial location correlates with physical health. There are, however, some limitations to bioarchaeological analysis. Termed "the osteological paradox," Wood and colleagues (1992) explain the fact that skeletal health does not always mirror an individual's current health. To prove their point, they state that the majority of diseases never evidence themselves osteologically. Furthermore, if a disease does have the ability to manifest itself skeletally, an immunologically weak person may die before the illness has a chance to do so. On the other hand, if a disease does manifest itself in bone, the argument could be made that the individual was immunologically strong and survived the first waves of microbial or parasitic attack. Cohen and colleagues (1984) refute this idea. They cite ethnographic examples as well as epidemiological principles to support the original contentions of Cohen and Armelagos (1984). Furthermore, Goodman and Martin state,

> Fortunately for the paleoepidemiologist, the stress response, a stereotypic physiological change resulting from the struggle to adjust, is frequently manifest in relatively permanent skeletal changes [Goodman and Martin 2002:18].

Nevertheless, considering the caveats mentioned by Wood and colleagues (1992), one might feel compelled to "throw in the towel." Yet, if we are to learn anything from archaeology, it is to work with what little we might have. Several studies of Mississippian sites have shown differences in health status that positively correlate with social rank, as evidenced by funerary items and/or burial location (Ambrose et al 2003; Betsinger 2002; Blakely 1995; Hatch and Geidel 1983; Hatch et al 1983; Hatch and Willey 1974; Langdon 1989).

However, a positive correlation between the two variables is not always present. While Betsinger (2002) found differences in health between individuals buried in mound and non-mound locations in the Tellico Reservoir of southeastern Tennessee, Parham (1982) found none at Toqua, one of the Tellico Reservoir sites. Harle (2003) found no statistically significant differences between individuals buried with and without funerary objects in the platform mound at Fains Island (a village sample of only six individuals made comparison between mound and village samples impossible). Powell (1992) studied health differences between “elite” and “non-elite” individuals at Moundville and found no significant differences overall, but like Harle (2003) bases her interpretation only upon funerary artifacts as no individuals from the mound burials were available for analysis. Powell (1992) does however note that there are inconsistent patterns between burial locations for four other Mississippian sites: Chucalissa, Dallas/Hixon (Powell did not know at the time of her analysis that these sites were not contemporary), Etowah, and King. At Chucalissa of southwest Tennessee, the tallest males were buried in mounds and there was less cranial osteoporosis and osteoarthritis in the mound, but there were no differences in periostitic reactions between the burial locations (Robinson 1976). At Dallas/Hixon of southeast Tennessee, trace element analysis proved that subadults in the mounds consumed significantly more protein than non-mound subadults (Hatch and Geidel 1983). No significant differences were found between mound and non-mound locations in stature, periostitis, osteoporosis, osteoarthritis, or trace elements (Blakely 1980; Blakely and Beck 1981) at the northwestern Georgia site of Etowah, but there did exist a significant difference for porotic hyperostosis (Blakely 1980). Finally, the King site of Georgia exhibited no significant differences between plaza and non-plaza interments with respect to stature, periostitis, linear enamel hypoplasias, or trace elements (Blakely 1988; Brown and Blakely 1985). It is important to note that these studies do not address all of the same pathological criteria and therefore a detailed comparison of all the sites based on certain criteria is not possible.

This study of the Cox site in the Norris Basin aims to employ bioarchaeological analysis in order to contribute to the literature concerning this inconsistent phenomenon in Mississippian mortuary patterns. It also endeavors to supplement the extensive scholarly discourse regarding archaeological correlates of rank. In the case of the Cox site, burial location is the only variable that can be used to distinguish possible social groupings, other than age and sex, because of the amateur recording methods used for investigations of the village. Information regarding presence or absence of funerary objects is inadequate. This shortcoming is discussed in more detail in the subsequent section about site history. Several additional questions that pertain to quality of life, co-adaptation with disease, and the complexity of Mississippian life in the Southeast are also addressed in this study.

A goal of this research is not only to add to the present literature illuminating patterns of health in the Mississippian Southeast, but also more specifically to discern whether or not burial in the mound versus the residential area at the Cox site correlates with differences in health status and possibly with social rank. The key question investigated here for the Cox site burial population is that if people buried in the mound had greater access to resources and were indeed of higher rank than most people buried in residential contexts, did the people in the mound also enjoy better health?

The biocultural perspective this study adopts is mirrored in countless bioarchaeological studies. Sofaer (2006) asserts that the body is a form of "material culture." Armelagos and Brown (2002:601) refer to bioarchaeology as putting "flesh [back] on… bones." Goodman and Martin (2002:13) state, "Bones and biologies come alive when they are seen as a part of interacting processes: biological, ecological, sociocultural, and political-economic." Bodily differences between groups based on age, sex or gender, rank, or a combination of these can be manifest in an individual's skeletal remains. These differences can be seen in musculoskeletal markers, dietary indicators, stature, and infection. Sofaer artfully describes this relationship between the individual and the environment:

> The skeleton embodies the history of social relationships and is an artifact of those relations. The life experiences of people have consequences for the ways that their bodies and those of others are formed, those experiences driving future actions. Descriptions of skeletal modifications or bone chemistry do not just represent lists of processes or events that happened to a particular individual, but are histories of relations between that person and others created through the constant alteration of skeletal structures and bone composition from the moment of conception until death, interacting with the inevitable age-related processes of growth and degeneration [Sofaer 2006:78].

Overall Patterns in Mississippian Health

In contrast to their foraging and horticultural predecessors, Mississippian societies are characterized by intensive reliance on maize agriculture (B. Smith 1986; Steponaitis 1986). Accompanying this shift in subsistence is a marked deterioration in health (Cohen and Armelagos 1984; Lambert 2000; Larsen 1995; Steckel and Rose 2002). This is evidenced by high rates of nutritional deficiency as well as dental and infectious disease.

As maize is a starchy plant, it tends to get lodged between teeth and stick to occlusal surfaces when consumed. This adhesion, in turn, leads to an oral microenvironment vulnerable to the development of dental caries. Numerous researchers, for example, have concluded through their studies that there is a higher rate of dental caries in agriculturalists versus hunter-gatherers (Ortner 2003; Powell 1985, 1988; Rose et al. 1991; M. Smith 1983).

For the purposes of this study, dental disease is indicated by carious lesions, calculus, incisal/occlusal wear, alveolar abscessing, antemortem tooth loss, and periodontal disease. Ortner (2003) mentions the fact that recording carious lesions can be problematic due to antemortem and postmortem tooth loss as well as incisal/occlusal wear. However, if all categories of dental pathology mentioned above are taken into consideration when estimating dental health, this problem of observing only dental caries to estimate dental health should be avoided.

Mississippian peoples also had an imbalanced diet because maize was so heavily relied upon as a food source. Lack of iron in the diet (previously, iron had been obtained by consuming meat) can lead to nutritional deficiency in the form of anemia (Stuart-Macadam 1992). But, one must be careful to note that anemia can also be the result of excessive bleeding due to menstruation or gastrointestinal infections (Ortner 2003). Furthermore, Stuart-Macadam (1992) notes that anemia can be the result of adaptation to infectious disease by starving pathogens of the iron they need. Whether from excessive bleeding, diet, or disease adaptation, iron deficiency or anemia is observable in bone as porotic hyperostosis and cribra orbitalia. These conditions manifest themselves when the cortical bone of the neurocranial vault and superior orbits, respectively, is obliterated to allow for the expansion of cancellous bone, which in turn permits expansion of marrow and increased production of red blood cells (Stuart-Macadam 1989). When porotic hyperostosis and cribra orbitalia are seen in adults, these conditions are healed lesions that represent childhood anemia (Ascenzi 1976; Stuart-Macadam 1985). Ortner (2003) notes that it is necessary to observe marrow hypertrophy in order to make a diagnosis of anemia, as mere porosity on the vault or orbital roofs is not pathognomic of the condition.

Rates of infectious disease also increased along with increased sedentism, which was necessary to maintain an agricultural lifestyle (Cohen and Armelagos 1984; Hudson 1965; Lambert 2000; Larsen 1994; Roberts and Buikstra 2003). As communities crowded together, certain diseases (like tuberculosis and the treponematoses) became more communicable (Powell 2000). Furthermore, it has been shown that nutritional deficiency is synergistic with infection (Allen 1984; Martorell 1980; Mata et al. 1971). Through skeletal analysis, a positive correlation between porotic hyperostosis (in this case representing iron deficiency anemia) and periostitis has been shown (Betsinger 2002; Powell 1988).

These three chronic conditions─dental disease, nutritional deficiency, and infectious disease─are frequently seen in Mississippian societies and are good indicators of health status for the Cox site population. The presence of linear enamel hypoplasias can also supplement the approximation of health status because these enamel defects document periods of growth disruption most likely caused by metabolic insult (Larsen 1997), thus allowing interruptions in periods of otherwise good health to be documented.

Health and Quality of Life

Allen (1984) notes that malnourishment can have a negative effect on a community's function by adversely affecting individuals' fertility and productivity. Moreover, because malnourishment and disease are synergistic, basic mobility may also be reduced with increased frequency of periostitic responses to infection.

Steckel and colleagues (2002) quantify and standardize health status so that comparisons regarding quality of life can be consistently made across sites. Their definition of "health status" is based on statistical calculations incorporating biological quality of life and health utility. The purpose of this standardization is to build upon the stress model developed by Goodman and Martin (2002), which focuses on health and adaptation.

"Quality of life" can be a vague concept in bioarchaeology, but if put solely in the biological context, bioarchaeological analysis can empirically examine life quality with respect to fertility, mobility, productivity, and morbidity. Individuals with poor health as indicated by skeletal remains likely had reduced fertility, mobility, and productivity accompanied by increased morbidity and a low biological quality of life.

Adaptation to Disease

Much has been written with respect to pre-Columbian and post-Columbian epidemiology (Armelagos and Dewey 1970; Brothwell 1991; Cockburn 1971; Crawford 1998; Diamond 1992, 1999; Inhorn and Brown 1990; Mitchell 2003; Ortner 2003; Powell 2000; Thornton 1987). Mitchell writes,

> Infectious disease has been part of the human experience from the very origin of the hominin lineage, but the forms that it takes and the effects exercised by different disease agents have altered enormously over time and space [Mitchell 2003:171].

Paleopathologists have delved into this intriguing subject by focusing on myriad diseases such as tuberculosis, leprosy, and treponematosis in addition to mycotic, viral, and parasitic illnesses (Aufderheide and Rodriguez-Martin 1998; Ortner 2003).

The Old and New Worlds developed very different disease trajectories because of differing patterns of settlement and population histories (Armelagos and Dewey 1970; Brothwell 1991; Cockburn 1971; Cohen et al. 1994; Crawford 1998; Diamond 1992, 1999). In short, New World populations developed less resilience to virulent crowd diseases because, by the time of Contact with Old World populations, most groups had only recently transitioned to agriculture and sedentism, conditions in which crowd diseases proliferated. With the rise of these large, agriculturally-based New World civilizations, infectious disease increased as evidenced by its detection in skeletal and mummified remains (Cohen and Armelagos 1984; Hudson 1965; Lambert 2000; Larsen 1994; Roberts and Buikstra 2003). The Old World populations, however, had a longer history of living in nucleated settlements than did New World inhabitants (Armelagos and Dewey 1970; Diamond 1992, 1999). Thus, Old World populations had more time to become genetically adapted to diseases associated with large settlements, namely zoonoses (Crawford 1998; Diamond 1992, 1999; Goodman and Martin 2002; Thornton 1987), diseases associated with animal husbandry. As Old World inhabitants domesticated animals like sheep and cows, they became increasingly exposed to certain pathogens these animals carried. This exposure led to increased immunity over time, as individuals who were able to survive the diseases reproduced and passed their genetic immunities onto offspring. Therefore, over a period of time, most Old World inhabitants expressed some form of immunity against zoonoses while New World inhabitants expressed virtually none.

Two diseases present in both the Old and New Worlds prior to Contact include the bacterial diseases treponematosis (Cockburn 1961; Hackett 1963; Hudson 1965, 1968; Hutchinson 1993; Hutchinson and Richman 2006; Hutchinson and Weaver 1998; Lambert 1999; Ortner 2003; Powell 1988; Powell and Cook 2005; M. Smith 2006; Stewart and Spoehr 1952) and tuberculosis, a zoonotic disease (Allison et al. 1973; Aufderheide and Rodriguez-Martin 1998; Bathurst and Barta 2004; Buikstra 1999; Elliot-Smith and Ruffer 1910; Ortner 2003; Roberts and Buikstra 2003; Roberts and Manchester 1995). These diseases can often be differentiated osteologically with respect to affected skeletal elements (Aufderheide and Rodriguez-Martin 1998; Ortner 2003;

Rogers and Waldron 1989). Prehistoric populations of Tennessee appear to have been affected by both treponemal disease (Jones 1876; Powell et al. 2005; M. Smith 2006) and tuberculosis (Lichtor and Lichtor 1957; Morse 1961; Roberts and Buikstra 2003). The Cox site skeletal series therefore was examined for both diseases, as possible etiologies for infectious lesions of bone.

As it is highly likely that the frequency of these two diseases increased as Native American populations became more sedentary, a biological adaptation to them is also likely to have occurred. Thus, exposure of both Old and New World populations to non-venereal treponemal disease and tuberculosis prior to the period of Contact may have allowed for these populations to not be as vulnerable to these diseases as to others (like venereal syphilis and smallpox, for example) following Contact. It should be mentioned, however, that Europeans had a significant health advantage over Native Americans in that they had a longer history of animal domestication and were more resistant to various zoonoses (Brothwell 1991; Diamond 1992, 1999). Diamond (1992, 1999) contends that European germs were the chief reason why the Native American population declined by approximately 95 percent. Through examination of the presence of these infectious diseases in the Cox site population, this study also contributes to our knowledge of infectious disease processes in the larger context of past and present global epidemiology.

Cox Site Excavation History

Norris Basin Excavations

The Cox Mound was excavated in 1934 under the supervision of William Webb, an archaeologist at the University of Kentucky (Figure 2). The site was included in a survey of the Norris Basin, located in east Tennessee. As the Tennessee Valley Authority

(TVA) had begun construction of the Norris Dam (named for Senator George Norris, of Nebraska, who supported the creation of the TVA) along the Clinch River in May 1933, concerned citizens proposed in August 1933 that archaeologists survey the river for prehistoric sites that were in danger of being inundated by the dam (Webb 1938). As historic tribes were reported as having occupied sites along the river, it was to be expected that archaeologists would find important burials and artifacts documenting their prehistoric existence (Webb 1938).

Acting as the supervising archaeologist, William Webb directed the archaeological investigations of the Norris Basin from January 8, 1934, until July 1, 1934, with the help of the Civil Works Administration and Federal Emergency Relief Administration. Webb and his colleagues discovered a total of 23 sites. Following their excavation, materials from each site were sent to various universities for analysis. Non-ceramic artifacts were sent to the University of Tennessee, ceramic artifacts were transferred to the University of Michigan, botanical material (wood) was sent to the University of New Mexico for dendrochronological analysis, and skeletal material was delivered to the University of Kentucky (Webb 1938). Some years later, most of the collections were consolidated at the University of Tennessee's McClung Museum.

Per Webb's report (1938), the Cox Mound was located on the farming land of Mr. A.B. Cox, the individual for whom the site is named. The land Mr. Cox owned had a history of being cultivated for 100 years and was planted with corn at the time of the excavation. Mr. Cox allowed excavation of the mound, but not the area surrounding it, thus precluding excavation of the village area. As a result of years of extensive cultivation of the land, the mound appeared as only a slight rise in the landscape.

Figure 2: Photo of the Cox Mound During Excavation. Taken May 21st, 1934. View to the northwest. Image courtesy of Frank H. McClung Museum, University of Tennessee.

Webb concluded,

> [Cox Mound] was not a burial mound in the ordinary sense; that is, it was not erected for the purpose of burial, or built up, as true burial mounds often are, by successive additions of earth used to cover the burials which from time to time were deposited on top of the previous burials [Webb 1938:163].

The mound was constructed as the result of several building episodes. There was evidence at the base of the mound of a primary structure that collapsed, which subsequently had a secondary structure built on top of it. As the loose earth of the collapsed primary structure could not adequately support the secondary structure, the secondary structure was reinforced by wooden posts that rested on rocks. There was a final, tertiary structure that was built upon the remains of the secondary structure when it collapsed. This structure had a prepared clay floor with a central fire pit. Thirty-nine individuals were interred in the floor of this tertiary structure. Eleven additional individuals were discovered outside of the structure’s walls (constituting part of the village burial sample). Thus the mound and peri-mound locations were completely excavated.

Pottery was analyzed by the New Deal–era crew and was found to be shell-tempered. James Griffin (1936) of the University of Michigan included the Cox site pottery in his dissertation study of the Norris Basin ceramics. Most ceramic vessels were small to medium in size, and a large number depicted frog effigies (Figure 3). Webb found no other sites in the Norris Basin depicting the frog iconography. Other artifacts (Figure 4) include stone and pottery disks, bone artifacts (awls, cut bone and antler, hairpins, and chisel), stone artifacts (spatulate celts, hammerstones, tools), and shell artifacts (ear spools, beads, mask gorgets, and rattlesnake gorgets).

With respect to cultural affiliation, Webb determined the Cox site’s mortuary patterning resembled Creek burial practices. The practice of burying individuals in an upright sitting posture (evidenced by three Cox burials) as well as placing strips of wood or bark above and below the body (as in five Cox burials) is very similar to Creek customs, according to the research performed by Webb. He was careful to state that he was not implying Creek affiliation, but was presenting it only as a possibility.

Figure 3: Cox Mound Pottery Sherds. Frog effigies seen along rims and handles.

Figure 4: Shell Gorgets from Mound (left) and Village (right). Rattlesnake iconography interpreted for both.

Melton Hill Excavations

Prior to the construction of the Melton Hill Dam (56 miles south of the Norris Dam) on the Clinch River, staff from the University of Tennessee's Department of Anthropology excavated portions of the Cox village under the supervision of Charles McNutt and with the assistance of the Tennessee Archaeological Society's Knoxville chapter (McNutt and Fischer 1960). During the first field season in 1960, the UT crew excavated a portion of the Cox Village which yielded evidence of Woodland and Late Mississippian occupations. See Figure 5 for a GIS representation of the site.

Forty-three burials were uncovered, 25 of which were assumed to belong to the preceding Woodland period (700 B.C. to A.D. 1000) based on poor preservation, depth, and associated funerary objects. Pottery appeared to be associated with Early and Middle Woodland as well as Late Mississippian time periods. Other artifacts included projectile points, pipes, bone ear spools, bone and shell beads, and other shell items. Botanical and faunal remains attributable to the Mississippian occupation consisted mainly of corn kernels, corncobs, deer bone, turtle shell, fish bone, and bird bone.

A lack of funding for the subsequent field season precluded UT staff participation in the second season of excavation in 1961, but the Tennessee Archaeological Society (TAS) continued excavating the site. TAS members uncovered approximately 200 additional burials. The records for this season are incomplete and many recovered artifacts were kept by the individuals who found them. These artifacts, unfortunately, have never resurfaced. These circumstances make interpretations of rank based on funerary objects impossible and is the primary reason why this study can only address rank with respect to burial location. Notes on funerary objects were available for some village burials, but the system of numbering burials used by TAS in the field does not correlate to the system used by McClung Museum. Therefore, documentation of funerary artifacts could not be associated with any burial from the village.

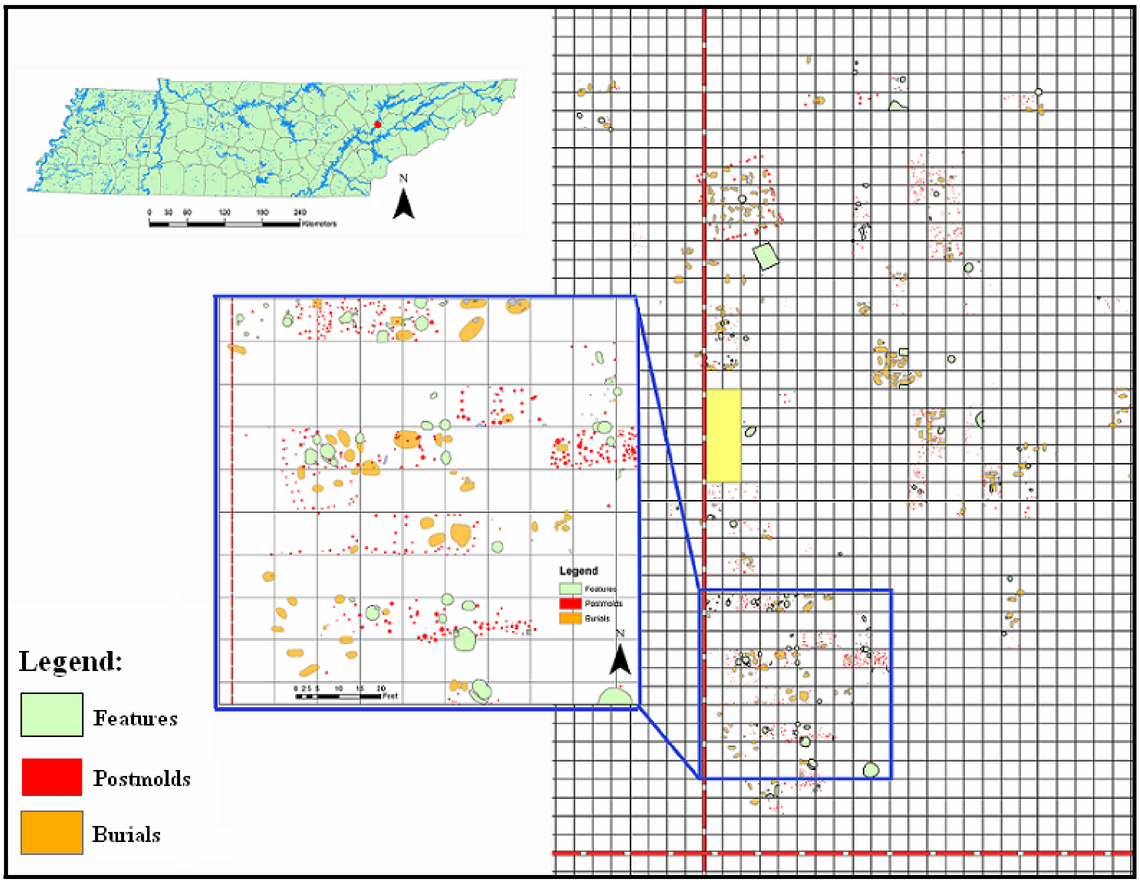

Figure 5: GIS Representation of 40AN19. Image courtesy of Bobby R. Braly.

CHAPTER THREE: SAMPLE AND METHODS

Description of Sample

The Norris Basin excavation of the Cox Mound yielded a complete sample of 50 individuals, 39 of whom were buried within the mound and 11 of whom were buried just along its periphery (and are therefore included in the village sample). The Melton Hill phases of village excavation produced a useable sample of 180 individuals. Final sample size, after problems of commingling and bone preservation were enumerated, totals 230 individuals (mound: n=39; village: n=191).

Before the Cox site became known as 40AN19, the mound and village were numbered separately. The mound had been referred to as 5AN19 and the village as 18AN19. This is an important distinction to make when viewing Appendices I and II.

Preservation of the entire sample is relatively good, with the exception of the burials McNutt (1960) assumed to be Woodland. These burials are not included in the sample, as McNutt and Fischer's (1960) criteria for assigning them to the Woodland period are trusted. The methods for determining what skeletal remains constitute an individual are discussed below.

During her NAGPRA (Native American Graves and Repatriation Act) inventory of the skeletal remains housed at the University of Tennessee's McClung Museum, Maria Smith and two of her co-workers estimated sex and age for each individual from the Cox site. These estimations, however, are not used in the present study. In this, all observations made with respect to each individual (age, sex, pathology) would be consistently made by one analyst.

Methods

Defining Individuals

What constituted an "individual" in terms of skeletal remains for the purposes of this study was continually refined during the course of the analysis. If bone preservation was too poor to yield any demographic or pathological information, the set of remains was not examined. The remains were also not analyzed nor included as an individual in the tallies if only one or two elements or fragments (especially isolated teeth) were present. Isolated teeth are problematic because they may be the result of commingling with another burial. Thus, isolated teeth were not counted as extra individuals. However, one exception was made: one child in the mound (Mound Burial 35) was represented only by teeth, but the age of the individual based on tooth development did not match the age of any other child present in the mound. Therefore, the child was counted as an extra individual. Commingled remains at times made it impossible to discern separate individuals. When individuals were defined, their remains were inventoried and degree of each element's preservation noted.

Sex

Determination of sex (for adults only) was made through examination of inominates, long bone morphology, and cranial characteristics. Inominates (after the criteria of Buikstra and Ubelaker 1994; Phenice 1969) were most heavily relied upon as indicators of sex and then, in descending order, long bone morphology and cranial characteristics. As long bone robusticity is generally more illustrative of the higher percentage of muscle mass men possess as opposed to females, it is a more reliable estimate of sex than are crania (Richard Jantz, personal communication 2005). Cranial characteristics, therefore, were the last criteria considered for estimating sex. Males were indicated by crania with relatively robust muscle attachments, evidenced in the parietals, glabella, mastoids, and mandible. Females, on the other hand, were indicated by more gracile muscle attachments in these four areas.

It must be noted here that this study will not use the terms “sex” and “gender” interchangeably, although some exceptions will be made when summarizing the work of others who do happen to use them interchangeably. “Sex” connotes a biological category based on primary (chromosomal) and secondary sex characteristics (the latter being the sole indicator for this study) while “gender” implies the social values, behaviors, and material goods associated with each sex in any given culture (i.e., in contemporary American society, a woman would be considered “masculine” if she competitively played football and/or smoked cigars). An individual may adopt the male or female gender irrespective of his or her biological sex characteristics or sexual preference.

Age

Age was estimated by examining several skeletal indicators. For adults (individuals aged 15 years and above), these included the pubic symphysis (using the criteria of Brooks and Suchey 1990; Todd 1921), auricular surface (after Lovejoy et al. 1985), and ribs (after Loth and Isçan 1989). In younger adults, the sternal end of the clavicle (if observable) or epiphyseal fusion (after Stevenson 1924) were used in age estimation. If all age indicators were present, they were used together to discern age. When no age indicators were present, the individual was categorized as an adult of indeterminable age. Teeth were not used as an indicator of age in adults as their wear can be variable across age groups in agricultural societies. This variation was evident in the extreme tooth wear observed in individuals who were of a young age, as verified by the more reliable age indicators in the inominates and ribs.

For subadults (ranging from newborn to age 15), tooth development was used to estimate age (using the dental chart provided by Ubelaker 1978). When no teeth were present, long bone length was used to estimate age (after Ubelaker 1978). When no aging criteria were present, the individual was categorized as a subadult of indeterminable age. It is important to note here that the terms "child" and "subadult" are used interchangeably. Between the ages of 15 to 20 years, most individuals had developed enough secondary sex characteristics to allow for an estimation of sex. Therefore, as sexual maturity had likely been reached by this time, individuals within this age cohort were considered adults.

Once a reliable estimate of age was obtained, individuals were placed in an age group: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

Pathology

The following variables were used to determine health status:

1.) Porotic hyperostosis
2.) Cribra orbitalia
3.) Dental pathology, evidenced by carious lesions, calculus, abscesses, antemortem tooth loss, wear, and periodontal disease.
4.) Cranial and/or postcranial indicators of infection, evidenced by pathological osteoblastic or osteoclastic activity
5.) Linear enamel hypoplasias

Together, these indicators measure nutritional deficiency (anemia) and growth disturbance as well as dental and infectious disease. Ortner's (2003) second edition of *Identification of Pathological Conditions in Human Skeletal Remains* was the primary source consulted when defining these pathologies. Degenerative joint disease was not considered as a health status indicator because preservation of joint surfaces was not good enough to allow for observation.

Porotic Hyperostosis and Cribra Orbitalia

Porotic hyperostosis and cribra orbitalia were recorded as present or absent. For the purposes of this study, severity was noted but not incorporated into the analysis of health status. When healed lesions were observed in adults, they were interpreted as evidence of childhood anemia (Stuart-Macadam 1985). Slight porosity on the cranial vault or orbital roofs was not taken to be indicative of anemia, as Ortner (2003) notes that several other conditions can produce this porous appearance.

Dental Disease

Dental health was graded on a scale that ranged from poor to good. Caries, abscesses, and antemortem tooth loss were quantified while the categories of calculus, wear, and periodontal disease were qualified with a designation of absent, minimal, moderate, or severe. With respect to overall dental health, each individual was given a composite score of poor, fair, or good based on the relative severity of each pathological category. For example, an individual (Village Burial 77) with ten caries, moderate calculus, moderate wear, two abscesses, antemortem loss of 9 teeth, and significant periodontal disease was given a score of "poor." An individual (Village Burial 78) with 2 caries, minimal calculus, moderate wear, one abscess, antemortem loss of one tooth, and moderate periodontal disease was given a score of “fair.” Finally, an individual (Village Burial 148) with one carie, minimal calculus, minimal wear, zero abscesses, no antemortem loss, and no periodontal disease was given a score of “good.” This method is somewhat subjective, but its strength is in its acknowledgement of six categories of dental pathology as opposed to one (i.e., carious lesions).

Infectious Disease

Estimation of infectious disease was also qualified by individual instead of quantified by skeletal element in order to diagnose systemic infection as well as infer possible etiologies (i.e., treponematosis or tuberculosis). In other words, instead of enumerating pathological tibiae (periostitic or osteomyelitic), for instance, each individual was evaluated for the presence or absence of a systemic infection typical to a disease process. If infectious diseases were measured by counting all tibiae with any sign of periostitis, results could be skewed because periosteal reaction on tibiae is a common occurrence and can often be the result of localized trauma (i.e., “bumping one’s shin”). As the diagnosis of specific diseases (which is relevant to any study discussing paleopathology and epidemiology) relies on looking at the particular skeletal elements they affect, for the purposes of this analysis, infectious disease was investigated on a case-by-case basis. When no determination of disease etiology could be made, nonspecific systemic infection was concluded.

Infectious disease was observed with respect to cranial and postcranial pathology. Observation of cranial pathology was limited to the vault (as it is usually better preserved than facial elements). Postcranial pathology was analyzed by looking at all observable postcranial elements.

When pathology indicative of infection was observed, an argument for treponematosis as a possible etiology was made when skeletal elements exhibited any systemic pattern of periostitis or osteomyelitis. Periostitis occurs when the outermost layer of bone, the periosteum, becomes inflamed and separates from the bone, creating new bone growth between it and the original cortical surface. If this build-up continues unchecked by normal endosteal osteoclastic activity, then the bone will appear thickened and inflamed, allowing the osteologist to observe an abnormal periostitic response.

Osteomyelitis, on the other hand, includes periostitis, but is also characterized by cloacae opening from the bone marrow and extending into the bone's cortex. These cloacae form when pus associated with a hematagenous infection accumulates in the bone marrow and is forced to tunnel through the bone's cortex to relieve endosteal pressure.

As treponemal disease often leads to systemic osteoblastic responses in the postcranial skeleton (as opposed to skeletal patterns of pathology associated with other common prehistoric diseases in the New World) (Ortner 2003), diagnosing it based on periostitis and osteomyelitis is reasonable. In the cranium, however, treponematosis can cause an osteoclastic response in the form of caries sicca (Ortner 2003; Rogers and Waldron 1989). The elements most frequently affected by the various treponematoses (yaws, endemic syphilis, and venereal syphilis) are seen in Table 1. Yet, in this study, no attempt to distinguish between the various treponematoses is made.

Tuberculosis is suggested as an etiology for conditions that included characteristic "moth-eaten" cranial lesions (Ortner 2003), endocranial hypervascularity (due to meningeal inflammation), tuberculous arthritis (especially in the hip), kyphosis of thoracic or lumbar vertebrae, or periostitis along rib surfaces (from excessive coughing).

Table 1: Elements Affected by Endemic Syphilis, Yaws, and Venereal Syphilis, as Defined by Steinbock (1976).

Elements Commonly Affected by Endemic Syphilis	Elements Commonly Affected by Yaws	Elements Commonly Affected by Venereal Syphilis
Nasals*	Distal Femora*	Cranial Vault*
Tibiae*	Tibiae*	Tibiae*
Fibulae*	Fibulae*	Clavicles
Cranial Vault	Cranial Vault	Manubrium and Sternum
Clavicles	Maxillae	Proximal and Distal Humeri
Radii	Zygomatics	Radii
Ulnae	Clavicles	Ulnae
Metacarpals and Hand Phalanges	Humeri	Metacarpals and Hand Phalanges
	Radii	Vertebrae
	Ulnae	Femoral Diaphyses and Distal Epiphyses
	Metacarpals and Hand Phalanges	
	Femoral Diaphyses	

*Elements frequently affected

Ortner (2003) contends that, although the skeletal manifestation of tuberculosis can be similar to that seen in other diseases, there are pathognomic indicators. He states that as tubercle bacilli often circulate in hemopoietic marrow, tuberculosis often affects areas of the skeleton with high amounts of cancellous bone. In adults, these are long bone epiphyses, vertebrae, ribs, and sterna. In infants and young children (who have more areas with hemopoietic marrow), these can include diaphyses and metaphyses as well as the flat bones of the cranial vault. Therefore, a more severe skeletal manifestation of tuberculosis is usually evident in infants and young children.

As both treponematosis and tuberculosis are manifest in both cranial and postcranial pathology, differential diagnosis of each disease for the Cox site population was based on these two variables. Pathology was defined by observance of either abnormal osteoclastic or osteoblastic activity in the cranium and postcranium.

Linear Enamel Hypoplasia

Linear enamel hypoplasias were recorded on the basis of presence or absence. All teeth were examined for evidence of these enamel defects. If an individual displayed multiple occurrences of the enamel defects (multiple periods of growth disturbance), these were noted, but not included in the final analysis of health status. Therefore, when hypoplasias were present, no distinction was made between individuals demonstrating several periods of growth disturbance and individuals demonstrating only one. If present, age at which the defect occurred was determined (after Goodman et al. 1980, 1984).

Overall Health Score

The overall health for each individual in the mound and village was estimated by creating a score ranging from 0 to 5, with 0 indicating absence of any pathology and 5 indicating presence of all 5 pathologies. If an individual exhibited a pathology, he or she was assigned a "1" to indicate its presence. Absence was denoted by a "0." Thus, each pathology was scored as present or absent. If an individual had a score of 3, for example, then he or she exhibited three of the five pathological conditions. This health score was used to compare the relative health status of individuals in each burial location.

Statistical Methods

In order to obtain the predictive value for the three variables of age, sex, and burial location in relation to one another, a logistic regression analysis was performed. This analysis excludes individuals of unknown age and uses an alpha of .05 in order to obtain a level of 95% predictive confidence.

Chi square tests were also performed in order to observe how strongly correlated age, sex, and pathological variables (including overall health status) were with respect to burial location. P-values were obtained for burial location's relationship with porotic hyperostosis, cribra orbitalia, linear enamel hypoplasias, poor/fair dental health, and infectious disease.

CHAPTER FOUR: RESULTS

Both mound and village samples exhibit certain demographic trends, but neither is significantly different from the other. Furthermore, with respect to overall health score, there is no statistically significant difference between mound and village, although there are, as with the demographic variables, visible trends. Appendices I and II list the findings obtained regarding sex, age, and health status for each individual.

Sex and Age

Within the mound, there are more males (53.8%, n=21) than females (25.6%, n=10). Given that this pattern is found at many Mississippian sites , this finding is not surprising. Of these males, 38.1% are in the younger age range (20-35). Only 25.6% of the mound sample is made up of women, but of the women for whom age is discernible, 50% (n=5) are older adults (50+). Twenty percent (n=8) of the mound sample includes subadults (one infant and seven older children). Figure 6 shows a more comprehensive representation of these age patterns**.** There are nearly equal percentages of males (30.9%) and females (31.4%) in the village (Figure 7). Yet, as with the mound, there are age differences between these two categories. There is an equal distribution of males in age groups 6 through 8 (20-50+ years, 8.9% for each group) while most females (18.9%) tend to be in the young adult age group (20-35 years). Subadults make up 37.7% of the village sample. Of these subadults, most (70.8%) are aged 0 to 5 years. Given the high subadult mortality rates seen in most Mississippian communities, this finding is not surprising (Cohen and Armelagos 1984; Goodman and Armelagos 1988, 1989). Figure 7 illustrates these patterns. Figures 8 and 9 depict side by side comparisons of each sample with respect to the variables of sex and age.

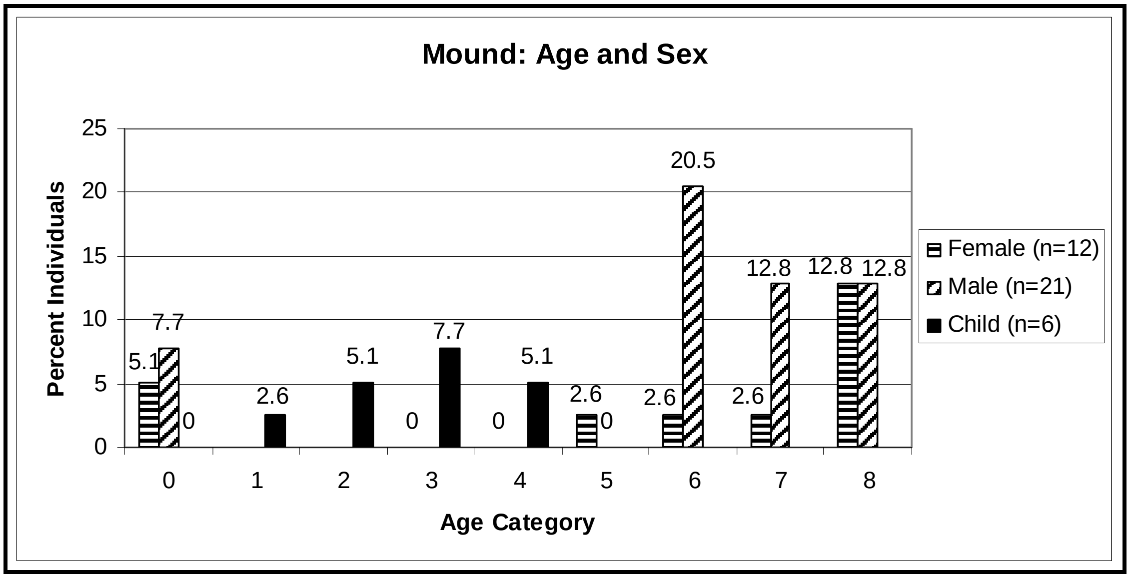

Figure 6: Distribution By Age and Sex for the Mound Sample. Age categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

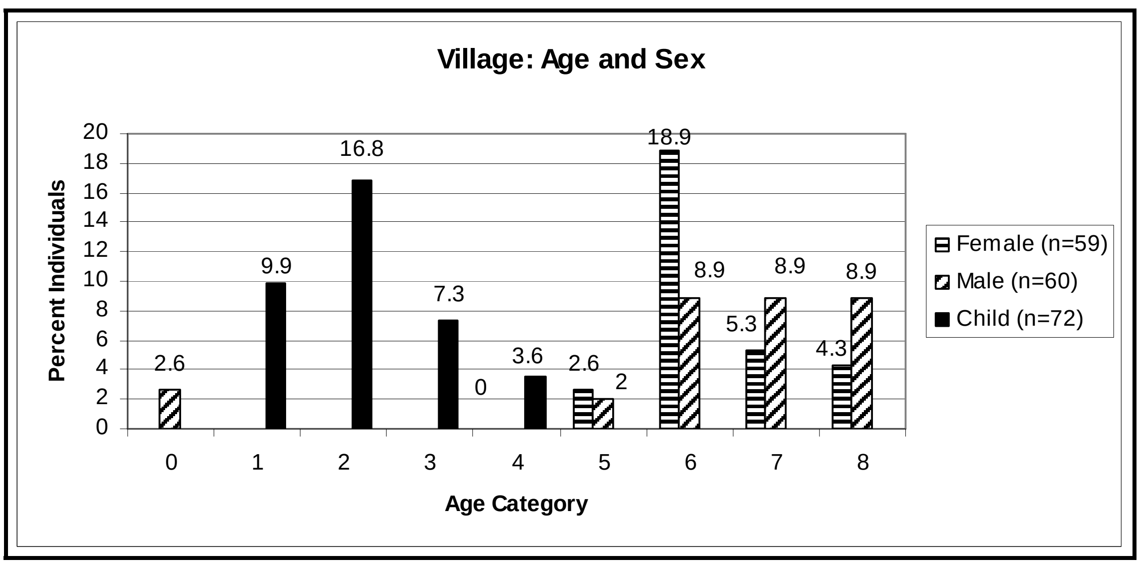

Figure 7: Distribution by Age and Sex for the Village Sample. Age categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

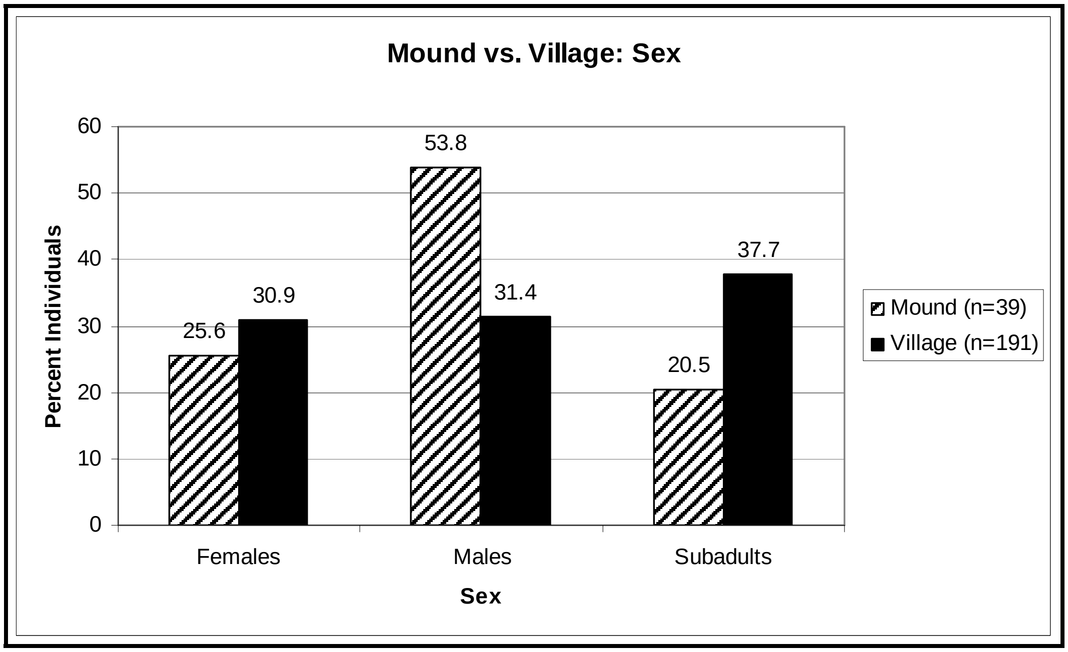

Figure 8: Distribution by Sex for Mound and Village Samples.

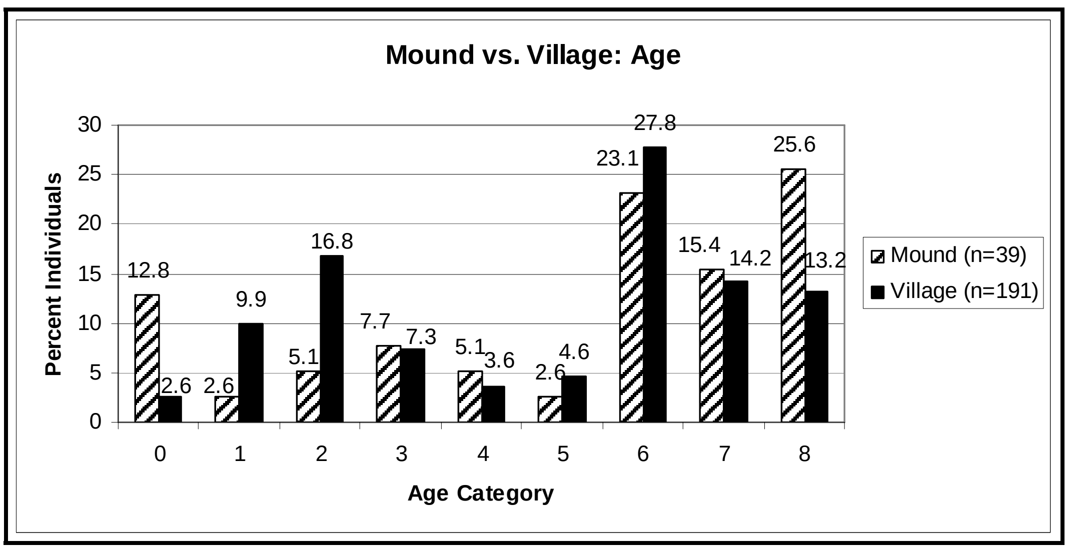

Figure 9: Distribution by Age for Mound and Village Samples. Age categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

A logistic regression performed on the data accounts for only 10% of the variation in the samples. Although this analysis is not a robust predictive model, it can account for general trends. With respect to demographics, at any given health score, the odds of being buried in the mound increase by a factor of 1.3 for every 1 unit increase in the age category. Therefore, as an individual increases in age from 20-35 years (Category 6) to 35-50 years (Category 7), he/she is 1.3 times more likely to be buried in the mound. Appendix III displays the output from the logistic regression.

Pathology

An overall representation of the differences in health between mound and village samples is seen in Figure 10. Chi-square analyses for all pathology categories are found in Appendix IV. The starkest contrast appears to be in the relative absence of anemia in the mound: no individual manifested the lesions typical to porotic hyperostosis and only two males in the mound sample have healed cribra orbitalia. Of 39 individuals, there are only 7.7% non-observable (N/O) cases of porotic hyperostosis (Figure 11). Non-observable cases indicate that the elements of the cranial vault affected by porotic hyperostosis (the parietal and occipital bones) were not present for analysis. A chi-square analysis of each pathology found that the only significant difference between mound and village samples was found in the frequency of porotic hyperostosis ($p= 0.005$). The small number of mound individuals with indicators of anemia might be related to the fact that there are only 6 children in the mound and skeletal indicators of anemia are more commonly seen in children than in adults (Stuart-Macadam 1985). Adults in the mound may have already experienced healing of the lesions. On the other hand, the large amount of individuals in the village with indicators of anemia might be a result of the

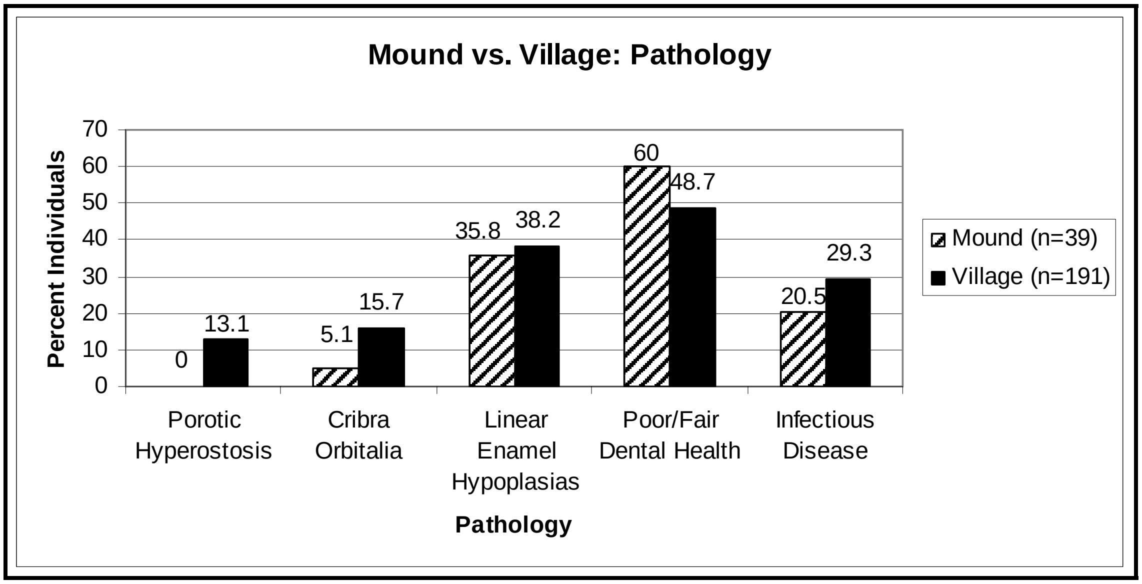

Figure 10: Distribution of Pathology in Mound and Village Samples.

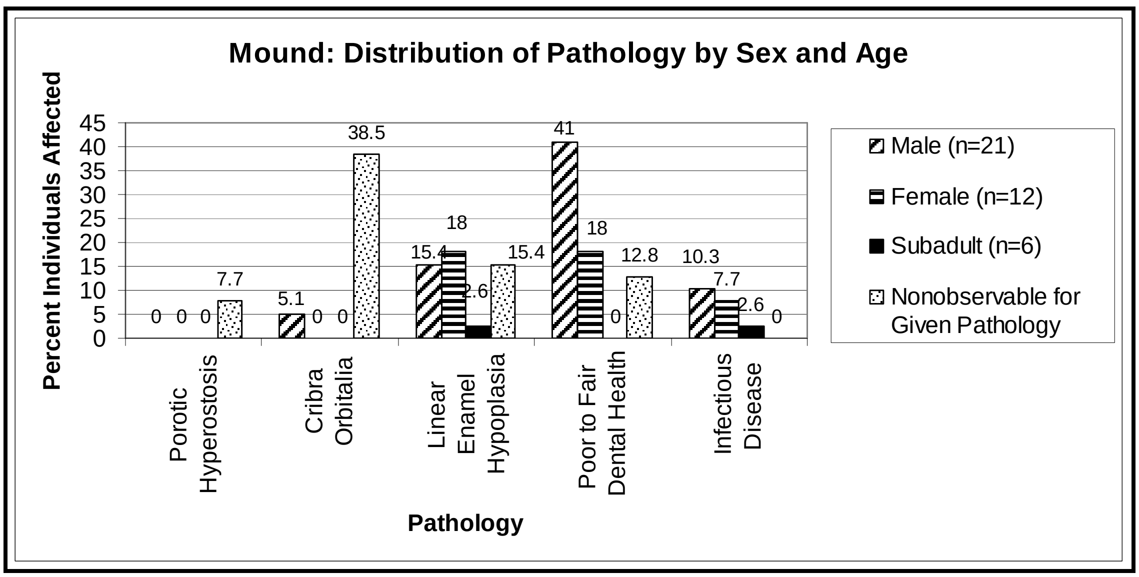

Figure 11: Distribution of Pathology by Sex and Age in the Mound Sample. Age categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

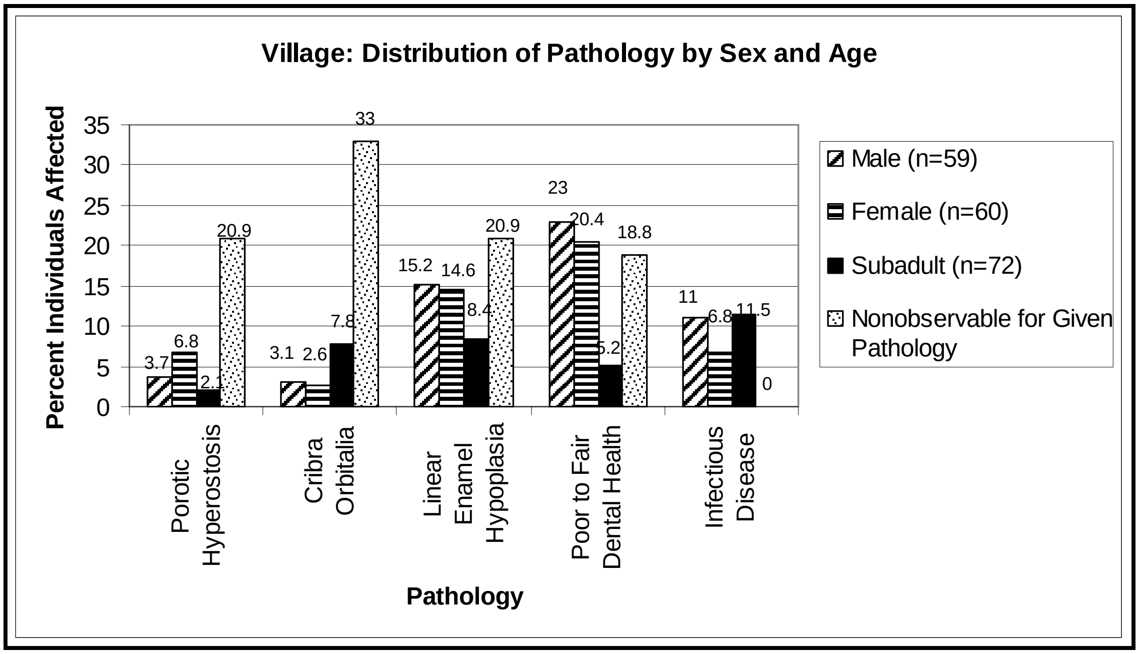

Figure 12: Distribution of Pathology by Sex and Age in the Village Sample. Age categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

Figure 13: Porotic Hyperostosis. Moderate porotic hyperostosis (active) in the parietal fragment of a 2- to 5-year-old child from the village sample (18AN19, burial 223).

Figure 14: Cribra Orbitalia. Significant cribra orbitalia in the right orbit of a 5- to 7-year-old child from the village (18AN19 donation, potential individual A).

higher number of subadults buried there (Figure 12). Figures 13 and 14 show afflicted individuals from the village.

Poor to fair dental health seems to have afflicted both mound and village individuals similarly, but males in the mound (41%) appear to be more affected by dental disease than females (12.8%). This pattern is possibly an artifact of sample bias, as there are more males than females buried in the mound. There are no subadults in the mound with poor to fair dental health, but this pattern may also be an artifact of sample bias as the mound subadult sample is small. Moreover, subadults in both samples are less likely to exhibit poor to fair dental health. The village sample appears skewed toward infants and younger children who died within the first five years of their lives (44% of the village subadults). These children likely had a different diet as opposed to adults (i.e., breastfeeding and weaning) and did not survive long enough to accumulate significant dental infection.

Infectious disease appears to be more frequent in the village versus the mound populations likely because of sample size difference. Both tuberculous (Figures 15, 16, and 17) and treponemal infection (Figure 18) appear to be present in the Cox site skeletal series, in addition to nonspecific infection. Although skeletal lesions characteristic of each disease were present, these diagnoses are tentative. All infectious disease appears more frequent in the village, but again, this may be due to sample bias.

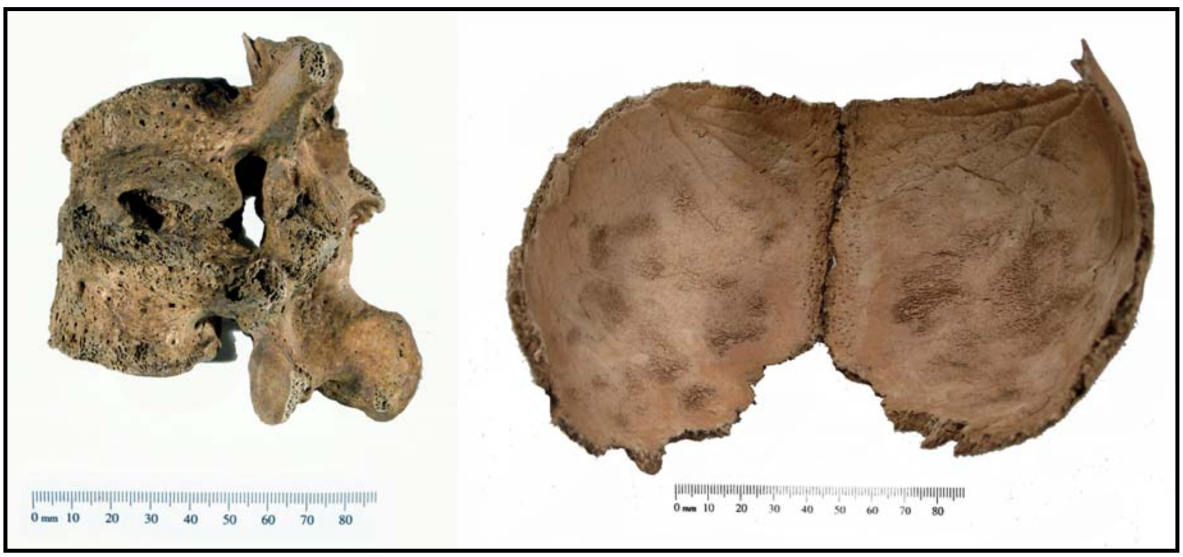

Figure 15: Possible Evidence for the Presence of Tuberculosis in the Village Sample. On left, kyphosis of lumbar vertebrae in a male aged 50+ years (5AN19, burial 4). On right, endocranial hypervascularity in a 3- to 5-year-old child (18AN19, burial 93).

Figure 16: Possible Evidence for the Presence of Tuberculosis in the Village Sample. Tuberculous arthritis in the left hip of a 50- to 60-year-old male (5AN19, burial 4). Note that this individual also displayed ankylosed vertebrae, referenced in Figure 15.

Figure 17: Possible Evidence for the Presence of Tuberculosis in the Village Sample. Periosteal reaction on the pleural surface (see inset) of three right ribs in a child aged 6 months to 2 years (18AN19, burial 225).

Figure 18: Possible Evidence for the Presence of Treponematosis in the Village Sample. Characteristic "saber shin" seen in the left tibia of a 6- to 10-year-old child (18AN19, burial 301).

Linear enamel hypoplasias affected both mound and village individuals similarly. There also appears to be no large difference in percentage of males and females affected in each sample (Figures 11 and 12). In the mound, more males are affected, but this is likely due to the fact that more males than females are buried in the mound. When observing ages at which growth disturbance occurs, most episodes fall between the ages of 2 to 5 years, for both mound (12 out of 17 hypoplasias; 85.7%) and village (72 out of 78 hypoplasias; 92.3%) samples (Figures 19 and 20). As this is the age range in which most subadults died, it appears to be a very vulnerable time in life.

With respect to overall health, there are some patterns worth noting. The majority of individuals in the mound (38.5%) have a health score of 1 whereas the majority of individuals in the village (32%) have a health score of 2 (Figure 21). These differences, however, are not statistically significant. A logistic regression of health score (Appendix III) indicates that at any given age, the odds of being buried in the mound should increase by a factor of 1.5 for every 1 unit decrease in the health score. Thus, regardless of age, if an individual exhibits one less pathology, he or she is 1.5 times more likely to be buried in the mound.

Figure 19: Linear Enamel Hypoplasias. Linear enamel hypoplasias in a village adult of indeterminable sex aged 15 to 20 years (18AN19, burial 112). These hypoplasias indicate periods of stress between the ages of 2 and 7 years.

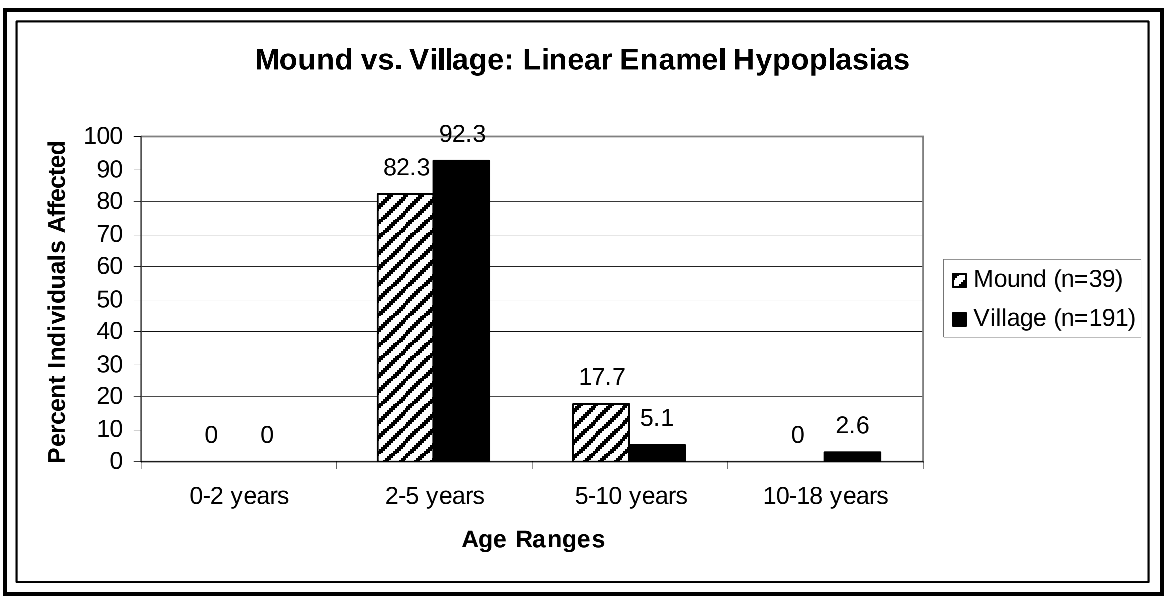

Figure 20: Linear Enamel Hypoplasia Age Distribution in Mound and Village. Frequencies of ages at which growth disruption occurred are taken from the total number of linear enamel hypoplasias at each site (mound: 17 total hypoplasias; village: 78 total hypoplasias). Note that there can be multiple hypoplasias per individual.

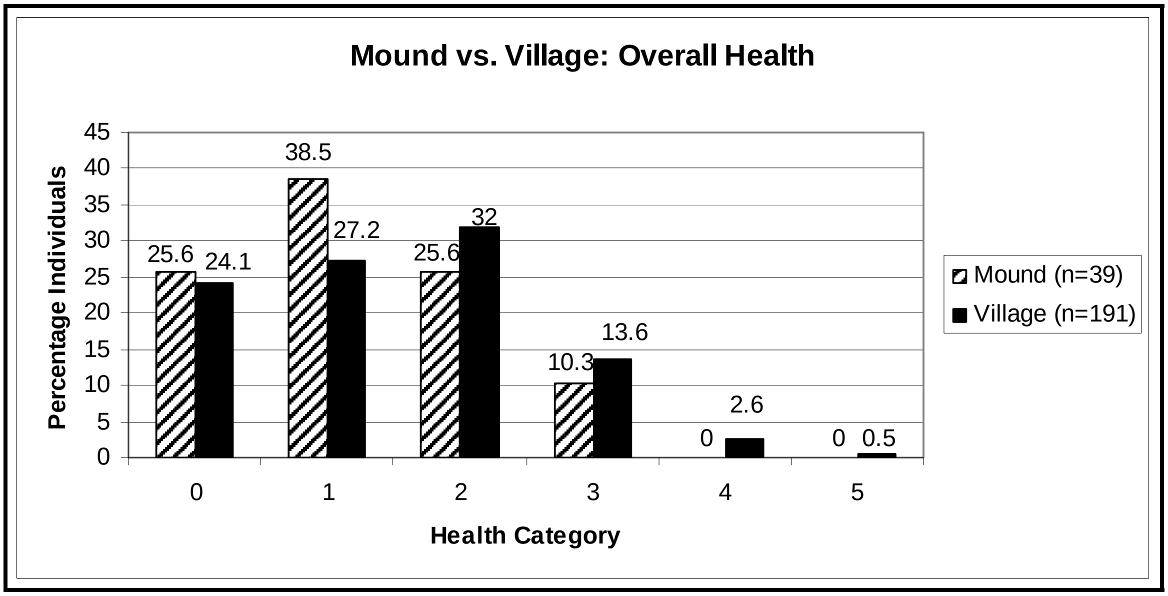

Figure 21: Distribution of Categories for Overall Health in the Mound and Village Samples. A health score of 0 indicates absence of any pathology while a health score of 5 indicates presence of all five pathologies.

CHAPTER FIVE: DISCUSSION

As mentioned in the introduction, this study aims to answer five questions. They will each be addressed below:

1.) *Do individuals in the mound exhibit lower rates of pathology when compared to individuals in the village, or vice versa? Do they exhibit equal rates of pathology? Does this reveal anything regarding differential health based on rank or status?*

The most noticeable difference between the mound and village samples with respect to pathology is seen in skeletal evidence of anemia. As discussed above, these differences could be explained by the larger number of subadults in the village versus the mound.

Langdon (1989), who has examined porotic hyperostosis at the Cox site, reports a real difference in rates of anemia between the mound and village, irrespective of sample demographics. This pattern could reflect a potential difference in diet (Peebles and Schoeninger 1981), as other studies (Bogan 1980) have shown differences in zooarchaeological remains between mound and village. Bogan (1980) contends that better pieces of meat were associated with mounds and likely given to elites as opposed to commoners. VanDerwarker (1999), in contrast, states that these remains suggesting better cuts of meat may have simply been associated with feasting activities on or near the mounds as opposed to being associated with a better elite diet. As previously mentioned, porotic hyperostosis and cribra orbitalia are indicative of childhood anemia. Therefore, if no adult males or females exhibit healed lesions of these conditions, inferences must be made with respect to childhood diet and not adult diet. At the Cox site, the data suggest that men, women, and children buried in the mound had a better childhood diet than individuals buried in the village. As most of the mound sample consists of men, the argument could be made that, as young boys, these men consumed more iron. It is possible they had the chance to consume iron from meat as "hunters-in-training." Yet, as evident in frequencies of linear enamel hypoplasias, both individuals in the mound and village suffered to a similar degree from growth disturbances, most likely caused by nutritional stress. As mentioned, many of these disturbances occur between the ages of two to five years. Therefore, although it is likely individuals from both burial locations were not immune to nutritional stress during this period of growth, individuals buried in the mound may have had more opportunities to consume iron between the ages of five to fifteen years.

Infectious disease shows no significant correlation with burial location. As both tuberculosis and treponemal disease are highly communicable diseases, infection being kept separate between elites and commoners was likely most difficult. The pathogen-laden mucus expelled by tuberculosis sufferers as they sneezed or coughed made it very easy for others to contract the infection. In addition, as children from both mound and village burial locations (which may represent elite and commoner sectors, respectively) likely interacted with one another and became infected through open sores on the skin (leading to chronic infection), it would be difficult to keep treponemal disease in one subset of the community.

Finally, both dental disease and linear enamel hypoplasia rates do not differ significantly between the mound and village samples. This result suggests that both elites and commoners were subject to the same dental infection associated with maize agriculture and the same growth disturbances, especially within the first five years of life. Irrespective of burial location, it appears that all individuals were vulnerable to not only growth disruptions, but also a high risk of mortality from the ages of zero to five. These hypoplasias, in conjuction with the high infant mortality rate (which is supported by the fact that 70.8% of the subadults in the village were under the age of five) might be explained by several factors (Danforth 1999): 1.) weaning stress; 2.) poor maternal nutrition; or 3.) population control methods including infanticide and deprivation of nutrients for reproductive-age females and young children. Although these last two reasons seem exceptionally heartless, we know some societies are not beyond them. One well-known example of societies trying to control population size is demonstrated in China where the limitation of only one child per couple has led to infanticide, especially if an infant was female.

2.) *Is there a preferential burial location for certain groups based on age, sex, or age and sex combined?*

As mentioned, there are more male burials in the mound versus female burials. There are also more adult burials in the mound versus subadult burials. Of the males in the mound, most are young. However, of the females in the mound, most are older. Males and females are equally represented in the village, but most of the females are within the young age range. These younger females (Age Category 6, 20 to 35 years) may have died due to complications in childbirth. Most subadults are buried in the village. A high proportion of these subadults are aged zero to five years.

If assuming that burial location correlates with rank, it appears that status is both ascribed and achieved. Ascription is evident in that subadults are buried in the mound (an elite burial for someone who has not yet had time to achieve status and is likely elite based on genealogy). Achieved status can be seen in the prevalence of certain age cohorts between mound and village (mound: young men and older women; village: young women).

Yet, the a priori assumption associating high rank with mound burials has been heavily critiqued. Sullivan adopts a more comprehensive analysis, stating,

> Spatial distinctions in burial locations for the genders could “mask” prestigious women because mounds and public areas are presumed to be the most prestigious place of interment for both sexes regardless of how prestige was earned. Different patterns of burial location for ‘elders’ of both sexes may indicate differences in how prestige is symbolized for members of different gender groups [Sullivan 2006:269].

The presence of older women in the Cox mound is in contrast to their complete absence in the mounds at the Mississippian Toqua and Dallas sites in southeastern Tennessee (Sullivan 2001, 2006). It may be possible that the younger men and some of the older women buried in the mound were more involved in the public sphere of inter-community relationships. If referring to ethnographic studies of the Cherokee, (possible Mississippians or descendants of Mississippians [Gerald Schroedl, personal communication 2006]), older matriarchs might have made decisions regarding conflict with other communities and potential battle while younger men might have proved their valor in warfare (Perdue 1998). A higher percentage of younger women may have been buried in the village as a result of being more instrumental in the domestic sphere (Sullivan 2001).

Another explanation for this demographic pattern could be related to the fact that there are very few incidences of antemortem trauma in both mound and village samples

Table 2*: Incidences of Antemortem Trauma in the Mound and Village Samples (10 of 230 Individuals, or 4.3%).

Site	Burial Number	Sex	Age Category	Cranial	Postcranial
mound	16	male	6	one, blunt force, healed	
mound	23	male	8	one, blunt force, healed	
village	113	female	6	one, blunt force, healed	
village	193	female	7	one, blunt force, healed	
village	137	female	8	one, blunt force, healed	
village	5	female	8	one, blunt force, healed	
village	76	male	6		1 rib frag with callus
village	160	male	6	one, blunt force, healed	
village	174	male	7		1 rib, blunt force, callus
village	136	male	8	one, blunt force, healed	

*Age categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

for the Cox site (Table 2). Although not included in this study's criteria for health status, antemortem trauma in any individual was still noted. As previously discussed, Sullivan (2006) holds that the domestic (female) and public (male) spheres of influence may be less polarized at the Dallas site because of less evidence for warfare. Sullivan draws upon the work of Maria Smith (2003), who finds very little evidence of antemortem trauma in Dallas phase sites of the Chickamauga Basin. In addition, the mound at Fains Island also contains more females than males in both the younger (20 to 30 years) and older (50+) age categories (Harle 2003). Therefore it is possible that Fains Island and the Cox site may be part of this trend. Perhaps older women are present in the mound because decreased warfare led to less polarization between the sexes. Alternatively, differences in mound burial patterns may reflect different cultural practices and possibly cultural affiliations between the more northerly Fains Island and Cox sites versus the more southerly Toqua and Dallas sites.

3.) *What will these results reveal with respect to the inhabitants' quality of life? How may fertility, mobility, and productivity have been affected?*

If the presence of anemia at the Cox site is due to diet, it could very well have weakened an individual's immune response. Several studies (Allen 1984; Betsinger 2002; Martorell 1980; Mata et al. 1971) have exposed the synergistic relationship between nutritional deficiency and infection. This relationship could also affect fertility, especially for women. If there are low levels of iron in the blood, conceiving a child and maintaining the fetus in the womb for nine months would be difficult.

Mobility and productivity would first and foremost be affected by the fatigue associated with anemia and infection. Secondly, if an individual was afflicted with treponematosis and his or her tibiae were affected (which most often are in treponemal disease), it could be very difficult for that individual to walk, let alone work.

With respect to growth disturbances, Goodman and Armelagos (1988, 1989) have shown through paleodemographic analysis that a shorter life expectancy is associated with individuals who expressed linear enamel hypoplasias.

The presence of anemia, painful dental disease, infection, and growth disturbances all likely contributed to a low quality of life for many individuals. Morbidity associated with each condition and the synergistic relationship between them all, in addition to shorter life expectancy, probably made life quite difficult for this Mississippian community.

4.) *In addition, what evidence is there in the prehistoric and historic context for the inhabitants' adaptation to certain pathological conditions? How should this study be placed within a larger epidemiological context?*

As mentioned in the literature review, it is likely that native populations were pre-adapted to certain infections, including tuberculosis and treponematosis. The Cox site skeletal sample suggests that these diseases were also present in late prehistoric east Tennessee. Both tuberculosis and treponematosis were observed in older individuals, suggesting the hosts were well-adapted enough to the pathogens in order for them, first of all, to express themselves skeletally and secondly to persist as possible chronic conditions through life (Wood et al. 1992).

As tuberculosis and treponematosis have been evidenced in both Old and New Worlds prior to Contact, both Europeans and Native Americans were likely well-adapted to the diseases' pathogens. However, at Contact, Old and New World populations were probably introduced to the specific strains endemic to the other. This exposure, in turn, may have led to increased mortality from each infection in both populations.

Perdue (1998) notes that for many Cherokee men, participating in warfare was a way to acquire status. As native populations were decimated by European diseases, however, the chances to successfully engage in warfare with Europeans would have been slim. Furthermore, as Diamond (1999) notes, Europeans were technologically superior and had weapons that were much more efficient in killing adversaries.

5.) *Finally, how will the results of this study compare to other Mississippian sites in east Tennessee as well as the larger Southeast?*

Steponaitis (1986) and others (Maxham 2000; Welch 2006) have noted that large Mississippian chiefdoms are connected to rural settlements via trade networks. These two areas constitute the core and the periphery, respectively. The power of leaders at these peripheral communities can be considerable (Meyers 2006), as some of them represent "nodal points" (Peregrine 1992:7) along trade routes. According to Meyers, these rural polities can be considered simple chiefdoms subsumed under larger complex chiefdoms. Among the peripheral polities Meyers studies is the Cox site. In her interpretation, it is part of one of these simple chiefdoms headed by an administrative center (site 40AN17, Lea Farm Village and Mounds) that also oversaw three other sites (but note that the contemporaneity of these sites is not confirmed). She believes the most important items traded here were salt and copper, but the 40AN17 polity is not located near these resources nor has direct evidence of large quantities of these items been found at these sites. Meyers suggests that the sites probably served as collection and distribution points along trade routes. She also thinks that this polity is similar to some other peripheral societies in that its administrative center is located along its edge as opposed to its core, making it less successful in trade in comparison to other polities with centrally placed administrative centers, one of which she believes to be the Holston/Nolichucky/French Broad polity. She suggests this polity contains 13 sites, including Fains Island, and appears to her to be the one located closest to a major Mississippian mound center (i.e., the core). Meyers believes that trade routes connecting these peripheral chiefdoms (including Cox) likely funneled goods toward southeast Tennessee (Citico being a primary trade center) or northern Georgia.

Meyers' study supports the fact that Late Mississippian sites in east Tennessee demonstrate considerable variability. Differences between the contemporary (mid-fifteenth to mid-sixteenth) southeastern Mouse Creek phase (primarily among the Hiwassee and Ocoee rivers) and late Dallas phase sites of east Tennessee have already been defined (Lewis and Kneberg 1941, 1946). Furthermore, past as well as ongoing research indicates that not all east Tennessee Late Mississippian sites (besides Mouse Creek) conform nicely to Dallas-phase standards (Lynne Sullivan, personal communication 2006). If sites within such a relatively small geographic area evidence variability, how can one assume that all Mississippian sites will conform to similar mortuary patterns? A priori notions of rank based on quality and quantity of funerary artifacts as well as burial location can no longer be supported in light of advances in Mississippian research.

Other bioarchaeological studies have attempted to define typical relationships between health and status at various Mississippian sites, but as previously mentioned, the findings are inconsistent. These findings again support the concept of variability in both core and peripheral areas Mississippian sites. The data gathered here on the Cox site represent just one more inconsistent finding in addition to the plethora of others which challenge the idea that the original characteristics of Mississippian chiefdoms (i.e., artifacts, mortuary patterning) are uniform in nature. This is one more case study that should prompt traditional Mississippian archaeologists to redefine what they consider "Mississippian."

CHAPTER SIX: CONCLUSION

This research has explored the intimate relationship between health and community. The Cox community appears similar to other Mississippian societies in its patterns of high infant mortality, dental disease, and communicable infection. Furthermore, Cox inhabitants likely suffered as a result of decreased fertility, mobility, productivity, and quality of life. The society at the Cox site is different from some other Mississippian societies, however, in that there are no significant differences in overall health status between mound and village locations. Therefore, social inequality in this late prehistoric community is not supported by any findings of biological inequality.

It appears that current medical innovations produced by advances in biomedical research allow a better biological division to be maintained among the upper and lower classes of the United States. As mentioned in the introduction, the absence in the United States of a better public healthcare system allows the upper classes access to the best healthcare money can buy while the poor must continue to suffer. One must wonder if this gap in economic status would be visible at these MississpMississpian sites if they too had access to such resources. Further ethnographic research on health status and burial location preferences among American economic classes would supplement this study well.

Thus, this study not only has relevance to health and status in Mississippian societies. It contributes just one more case study to the vast amount of literature on both power relations and mortuary studies. As an anthropology student, this broad applicability is what I ultimately aim to accomplish. The holistic nature of anthropology has encouraged me to draw knowledge from various disciplines while conducting this study, including biology, sociology, psychology, chemistry, and philosophy. Huntington and Metcalf state (1979:2), "in all societies… the issue of death throws into relief the most important cultural values by which people live their lives and evaluate their experiences." What could be more encompassing and informative than that?

However, if there is one thing we have learned from critiques of processual archaeology, it is the dangers of over-generalizing. Variability is just as important as similarity. Archaeologists, biological anthropologists, and linguists should first and foremost be cultural anthropologists and be cognizant of the fact that striking a delicate balance between universalism and relativism is paramount. One must understand the range of variability in behavioral responses to common human experiences. This study concerns only one of these responses: the individual and group responses toward death, a ubiquitous force in any society. The scientist must attempt to measure how behavior (the independent variable) relates to this experience (the constant), whether it be through the study of artifacts, funerary pomp and ritual, skeletal remains, or burial location. Short of jumping into people's minds, this is the best we can do.

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APPENDIX ONE

HEALTH SCORE INFORMATION FOR
INDIVIDUALS BURIED IN THE MOUND

Appendix I: Health Score Information for Individuals Buried in the Mound*

Site No.	Burial No.	Sex	Age Category	Cribra Orbitalia	Porotic Hyperostosis	Poor to Fair Dental Health	Infectious Disease	Hypoplasias	Health Score
5AN19	11A	female	6	n/o	0	1	0	0	1
5AN19	11B	male	6	0	n/o	n/o	0	n/o	0
5AN19	13	male	8	0	0	1	0	0	1
5AN19	14	female	8	n/o	0	1	1	1	3
5AN19	15	child	3	n/o	0	0	0	0	0
5AN19	16	male	6	0	0	1	0	1	2
5AN19	17	male	7	0	0	1	0	1	2
5AN19	18	male	0	n/o	0	1	0	0	1
5AN19	19	female	4	n/o	0	0	0	1	1
5AN19	20	male	8	0	0	1	0	1	2
5AN19	21	female	7	0	0	0	0	1	1
5AN19	22	female	0	n/o	0	0	0	1	1
5AN19	23	male	8	0	0	1	0	0	1
5AN19	24A	male	6	0	0	0	0	0	0
5AN19	24B	male	0	1	0	1	0	0	2
5AN19	26	female	8	n/o	0	n/o	0	n/o	0
5AN19	27	male	8	n/o	n/o	n/o	0	n/o	0
5AN19	28	male	7	0	0	1	1	1	3
5AN19	29	female	8	n/o	n/o	n/o	1	n/o	1
5AN19	31	male	8	0	0	1	1	1	3
5AN19	32	male	7	0	0	1	0	0	1
5AN19	32-A	male	0	0	0	1	0	0	1
5AN19	33	female	0	n/o	0	1	0	1	2
5AN19	34	female	8	0	0	1	1	1	3
5AN19	35	female	4	n/o	0	1	0	1	2
5AN19	35-extra	child	1	n/o	n/o	n/o	0	n/o	0
5AN19	36	female	8	0	0	1	0	0	1
5AN19	37	child	2	n/o	0	0	1	0	1
5AN19	38	female	5	0	0	1	0	0	1
5AN19	39	male	6	0	0	1	1	0	2
5AN19	40	child	3	n/o	0	0	0	1	1
5AN19	41A	male	7	n/o	0	0	0	n/o	0
5AN19	42	male	6	1	0	1	0	0	2
5AN19	43	male	6	0	0	1	0	0	1
5AN19	44	male	6	0	0	1	1	0	2
5AN19	45	male	6	0	0	1	0	1	2
5AN19	46	male	7	0	0	0	0	0	0
5AN19	47	child	3	0	0	0	0	0	0
5AN19	48	child	2	0	0	0	0	0	0

*Coding System: n/o = non-observable, 0 = absent, 1 = present. Age Categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

APPENDIX TWO

HEALTH SCORE INFORMATION FOR
INDIVIDUALS BURIED IN THE VILLAGE

Appendix II: Health Score Information for Individuals Buried in the Village*

Site No.	Burial No.	Sex	Age Category	Cribra Orbitalia	Porotic Hyperostosis	Poor to Fair Dental Health	Infectious Disease	Hypoplasias	Health Score
5AN19	1	male	7	0	0	1	0	0	1
5AN19	2	female	8	0	0	1	0	0	1
5AN19	3	male	5	1	0	0	0	1	2
5AN19	4	male	8	0	0	1	1	0	2
5AN19	5	female	8	n/o	0	1	0	0	1
5AN19	5- extra	female	6	n/o	0	n/o	0	n/o	0
5AN19	7A	child	1	n/o	n/o	n/o	0	n/o	0
5AN19	7B	male	8	0	0	1	0	1	2
5AN19	8	male	6	n/o	0	1	0	0	1
5AN19	9	male	8	0	0	1	0	0	1
5AN19	10	child	2	0	0	0	0	0	0
18AN19	1	child	1	n/o	0	n/o	0	n/o	0
18AN19	2	male	6	n/o	n/o	n/o	0	n/o	0
18AN19	5	male	7	0	0	1	1	0	2
18AN19	6	male	7	0	0	1	1	0	2
18AN19	7B	Male	8	0	0	1	1	0	2
18AN19	7D	male	8	0	n/o	n/o	0	n/o	0
18AN19	7D-extra	female	6	n/o	n/o	n/o	0	n/o	0
18AN19	8	male	0	n/o	0	1	0	1	2
18AN19	9	male	8	0	0	1	0	0	1
18AN19	10A	female	6	0	0	1	1	1	3
18AN19	31	child	3	0	0	1	0	0	1
18AN19	31-extra	child	2	n/o	n/o	n/o	0	n/o	0
18AN19	33	female	5	0	0	0	1	1	2
18AN19	34	child	2	n/o	n/o	0	0	0	0
18AN19	35A	male	0	0	0	1	0	1	2
18AN19	36	child	2	1	n/o	0	0	1	2
18AN19	38	child	2	0	0	0	0	0	0
18AN19	39	male	8	0	0	1	1	1	3
18AN19	40	female	8	0	0	1	0	0	1
18AN19	43	male	0	0	0	1	0	1	2
18AN19	44A	female	6	0	0	1	0	0	1
18AN19	44B	child	1	n/o	n/o	n/o	0	0	0
18AN19	45	child	2	n/o	0	0	0	1	1
18AN19	46	male	5	n/o	0	0	0	1	1
18AN19	47	male	0	0	0	1	0	1	2
18AN19	48	male	8	1	0	1	1	0	3
18AN19	49	child	1	1	0	0	1	0	2
18AN19	50	child	2	n/o	0	0	n/o	0	0

*Coding System: n/o = non-observable, 0 = absent, 1 = present. Age Categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

Appendix II, continued: Health Score Information for Individuals Buried in the Village*

Site No.	Burial No.	Sex	Age Category	Cribra Orbitalia	Porotic Hyperostosis	Poor to Fair Dental Health	Infectious Disease	Hypoplasias	Health Score
18AN19	51	child	2	n/o	n/o	0	n/o	0	0
18AN19	52	male	7	1	0	1	0	0	2
18AN19	53	child	3	0	0	1	0	1	2
18AN19	54	male	7	1	1	1	0	0	3
18AN19	55	female	6	n/o	0	n/o	0	n/o	0
18AN19	56	male?	5	n/o	0	1	0	1	2
18AN19	57	male	8	n/o	n/o	1	0	1	2
18AN19	58	female	7	0	0	1	0	1	2
18AN19	58-extra2	child	1	n/o	n/o	n/o	n/o	n/o	0
18AN19	59	child	3	n/o	0	n/o	1	0	1
18AN19	60	child	4	n/o	0	1	0	1	2
18AN19	62	male	8	0	0	1	0	1	2
18AN19	63	male	8	0	0	1	1	1	3
18AN19	64	child	2	0	0	0	0	n/o	0
18AN19	65	male	8	0	0	1	0	1	2
18AN19	66	male	8	0	0	1	0	1	2
18AN19	67	female	7	0	0	1	0	0	1
18AN19	67-extra1	male	6	n/o	n/o	1	0	n/o	1
18AN19	67-extra2	child	3	n/o	n/o	0	n/o	0	0
18AN19	68	female	7	1	0	1	0	0	2
18AN19	69	male	6	1	1	1	1	1	5
18AN19	70	male	7	1	0	1	1	1	4
18AN19	71	child	3	n/o	n/o	1	1	1	3
18AN19	72	child	1	1	0	1	1	0	3
18AN19	74	male	6	0	1	1	1	1	4
18AN19	75	female	5	0	0	0	0	1	1
18AN19	76	male	7	0	0	1	0	1	2
18AN19	77	female	8	0	1	1	1	1	4
18AN19	77A	child	1	n/o	n/o	n/o	0	n/o	0
18AN19	78	female	7	0	0	1	0	1	2
18AN19	79	female	6	n/o	n/o	n/o	0	n/o	0
18AN19	80	female	6	1	0	1	0	1	3
18AN19	81	female	7	n/o	0	1	0	0	1
18AN19	82	child	2	1	0	n/o	1	n/o	2
18AN19	83	child	1	0	0	0	1	0	1
18AN19	84	female	4	n/o	0	0	0	0	0
18AN19	85	child	2	1	0	0	1	0	2
18AN19	86	female	8	n/o	0	1	0	1	2
18AN19	86-extra1	male	0	n/o	n/o	n/o	1	n/o	1
18AN19	86-extra2	child	1	n/o	n/o	n/o	1	n/o	1

*Coding System: n/o = non-observable, 0 = absent, 1 = present. Age Categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

Appendix II, continued: Health Score Information for Individuals Buried in the Village*

Site No.	Burial No.	Sex	Age Category	Cribra Orbitalia	Porotic Hyperostosis	Poor to Fair Dental Health	Infectious Disease	Hypoplasias	Health Score
18AN19	86-extra4	child	1	n/o	n/o	n/o	1	n/o	1
18AN19	89	child	2	0	0	0	0	0	0
18AN19	90	child	2	1	0	0	1	0	2
18AN19	91	child	2	n/o	0	0	1	0	1
18AN19	92	female	7	0	0	1	1	0	2
18AN19	93	child	2	1	0	0	1	0	2
18AN19	94	male	8	0	0	1	0	1	2
18AN19	95	female	7	1	0	1	0	0	2
18AN19	96	child	1	1	0	0	0	0	1
18AN19	97	child	2	n/o	n/o	n/o	0	n/o	0
18AN19	98	child	1	n/o	0	n/o	0	n/o	0
18AN19	99	child	1	n/o	0	n/o	0	0	0
18AN19	100	child	4	n/o	n/o	0	0	1	1
18AN19	102	female	6	n/o	n/o	n/o	0	n/o	0
18AN19	103	child	2	1	0	0	0	0	1
18AN19	104	child	3	n/o	0	0	0	1	1
18AN19	105	female	6	0	1	1	0	1	3
18AN19	105-extra	male	8	n/o	n/o	n/o	0	n/o	0
18AN19	106	female	6	0	0	0	0	0	0
18AN19	107	female	7	n/o	0	1	0	0	1
18AN19	108	male	7	0	0	1	0	1	2
18AN19	109	female	6	1	0	0	0	0	1
18AN19	110	child	2	n/o	n/o	0	0	0	0
18AN19	111	child	3	n/o	0	0	1	1	2
18AN19	112	male	5	0	n/o	0	0	1	1
18AN19	113	female	6	0	0	1	0	0	1
18AN19	114	female	6	0	0	1	0	0	1
18AN19	115A	child	1	1	0	0	1	0	2
18AN19	116	child	2	1	0	1	0	1	3
18AN19	117	female	7	0	0	1	0	0	1
18AN19	118	child	2	1	0	0	1	1	3
18AN19	119	female	7	0	0	1	0	n/o	1
18AN19	120	female	6	0	0	0	1	0	1
18AN19	121	female	7	0	0	1	0	1	2
18AN19	122	male	6	0	0	1	1	1	3
18AN19	123	child	3	n/o	0	1	0	0	1
18AN19	124	child	1	n/o	0	n/o	0	n/o	0
18AN19	125	female	6	0	0	0	0	0	0
18AN19	126A	male	6	0	0	1	1	0	2
18AN19	126-extra3	child	1	0	0	n/o	0	0	0

*Coding System: n/o = non-observable, 0 = absent, 1 = present. Age Categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

Appendix II, continued: Health Score Information for Individuals Buried in the Village*

Site No.	Burial No.	Sex	Age Category	Cribra Orbitalia	Porotic Hyperostosis	Poor to Fair Dental Health	Infectious Disease	Hypoplasias	Health Score
18AN19	127	child	2	n/o	n/o	n/o	0	n/o	0
18AN19	128	female	6	n/o	1	0	0	1	2
18AN19	129	female	6	0	0	1	1	0	2
18AN19	130	child	3	1	0	1	0	0	2
18AN19	131	female	6	0	0	1	1	1	3
18AN19	133	child	2	n/o	0	n/o	0	n/o	0
18AN19	135	female	6	1	1	1	0	1	4
18AN19	136	male	8	0	0	1	1	0	2
18AN19	137	female	8	0	1	1	0	1	3
18AN19	138	male	6	0	0	1	0	1	2
18AN19	139	female	8	0	0	1	1	1	3
18AN19	139	female	8	0	1	1	0	1	3
18AN19	140	female	7	0	0	1	0	1	2
18AN19	141	female	7	n/o	n/o	1	0	n/o	1
18AN19	142	female	6	n/o	n/o	n/o	0	1	1
18AN19	143	female	6	n/o	n/o	0	0	n/o	0
18AN19	144	female	6	0	0	n/o	0	0	0
18AN19	145	child	3	0	1	0	0	1	2
18AN19	146	female	6	1	0	1	0	0	2
18AN19	147	child	3	0	1	0	1	1	3
18AN19	148	female	6	n/o	1	0	0	1	2
18AN19	149	female	6	n/o	0	0	1	1	2
18AN19	150	child	2	n/o	1	0	0	n/o	1
18AN19	151	male	7	0	1	n/o	1	1	3
18AN19	152	female	6	0	1	1	0	0	2
18AN19	156	child	2	1	1	0	0	1	3
18AN19	157	child	4	n/o	1	0	0	1	2
18AN19	159	male	7	n/o	0	1	1	n/o	2
18AN19	160	male	6	0	1	n/o	0	1	2
18AN19	164	female	6	0	0	1	1	1	3
18AN19	165	female	6	0	1	1	1	1	4
18AN19	166	female	7	0	0	1	1	1	3
18AN19	169	child	4	0	0	0	0	1	1
18AN19	170	male	8	0	0	1	0	n/o	1
18AN19	171	female	7	n/o	n/o	n/o	0	n/o	0
18AN19	172	child	2	n/o	n/o	n/o	1	n/o	1
18AN19	173	male	6	n/o	n/o	n/o	1	n/o	1
18AN19	174	male	7	n/o	0	1	0	0	1
18AN19	175	child	2	0	0	0	1	0	1
18AN19	176	male	7	n/o	0	1	0	1	2

*Coding System: n/o = non-observable, 0 = absent, 1 = present. Age Categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

Appendix II, continued: Health Score Information for Individuals Buried in the Village*

Site No.	Burial No.	Sex	Age Category	Cribra Orbitalia	Porotic Hyperostosis	Poor to Fair Dental Health	Infectious Disease	Hypoplasias	Health Score
18AN19	177	female	6	n/o	0	n/o	0	n/o	0
18AN19	178	female	7	0	0	1	0	0	1
18AN19	179	male	6	0	0	0	1	1	2
18AN19	181	male	7	0	0	1	1	0	2
18AN19	182	child	2	n/o	0	0	1	0	1
18AN19	183	child	3	n/o	1	1	0	1	3
18AN19	184	male	6	n/o	n/o	0	0	1	1
18AN19	185	child	1	n/o	n/o	n/o	0	n/o	0
18AN19	186	child	1	n/o	n/o	n/o	0	n/o	0
18AN19	187	child	4	n/o	n/o	0	0	0	0
18AN19	188	male	7	0	1	0	0	1	2
18AN19	189	female	5	0	1	0	0	1	2
18AN19	190	child	3	n/o	0	1	0	1	2
18AN19	191	male	6	0	0	1	1	1	3
18AN19	192	female	6	0	0	1	1	0	2
18AN19	192A	male	6	n/o	n/o	0	0	0	0
18AN19	193	female	7	0	1	1	0	1	3
18AN19	194	male	7	0	0	1	1	1	3
18AN19	195	male	7	0	0	1	0	n/o	1
18AN19	196	female	7	0	0	1	0	n/o	1
18AN19	197	male	7	0	1	1	0	0	2
18AN19	198	male	6	n/o	n/o	n/o	0	n/o	0
18AN19	199	male	6	n/o	n/o	n/o	0	n/o	0
18AN19	203	male	6	n/o	n/o	1	0	0	1
18AN19	223	child	2	1	1	0	0	0	2
18AN19	225	child	1	0	0	0	1	0	1
18AN19	301	child	3	1	0	0	1	1	3
18AN19	BoxBu56	child	1	n/o	0	0	0	0	0
18AN19	DonA	child	3	1	0	0	0	0	1
18AN19	DonB	child	1	1	0	0	1	0	2
18AN19	DonC	child	2	n/o	0	0	n/o	0	0
18AN19	DonE	child	1	n/o	0	n/o	0	n/o	0

*Coding System: n/o = non-observable, 0 = absent, 1 = present. Age Categories: (0) indeterminate; (1) 0-2 years; (2) 2-5 years; (3) 5-10 years; (4) 10-15 years; (5) 15-20 years; (6) 20-35 years; (7) 35-50 years; and (8) 50+ years.

APPENDIX THREE

LOGISTIC REGRESSION
OUTPUT FROM SPSS

Logistic Regression
excludes individuals with unknown age

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	220	100.0
	Missing Cases	0	.0
	Total	220	100.0
Unselected Cases		0	.0
Total		220	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
village	0
mound	1

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			site_location		Percentage Correct
	Observed		village	mound	
Step 0	site_location	village	186	0	100.0
		mound	34	0	.0
	Overall Percentage				84.5

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.699	.187	83.014	1	.000	.183

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	age_cat	5.752	1	.016
		HEALTH_SCORE	1.657	1	.198
	Overall Statistics		10.394	2	.006

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	11.033	2	.004
	Block	11.033	2	.004
	Model	11.033	2	.004

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	178.393[a]	.049	.085

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Classification Table[a]

			Predicted		
			site_location		Percentage Correct
	Observed		village	mound	
Step 1	site_location	village	186	0	100.0
		mound	34	0	.0
	Overall Percentage				84.5

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	age_cat	.272	.095	8.110	1	.004	1.312
	HEALTH_SCORE	-.418	.197	4.500	1	.034	.658
	Constant	-2.636	.566	21.701	1	.000	.072

a. Variable(s) entered on step 1: age_cat, HEALTH_SCORE.

Crosstabs

age_cat * location Crosstabulation

			location		Total
			mound	village	
age_cat	0	Count	5	5	10
		% within location	12.8%	2.6%	4.3%
	1	Count	1	22	23
		% within location	2.6%	11.5%	10.0%
	2	Count	2	29	31
		% within location	5.1%	15.2%	13.5%
	3	Count	3	15	18
		% within location	7.7%	7.9%	7.8%
	4	Count	2	7	9
		% within location	5.1%	3.7%	3.9%
	5	Count	1	6	7
		% within location	2.6%	3.1%	3.0%
	6	Count	9	46	55
		% within location	23.1%	24.1%	23.9%
	7	Count	6	36	42
		% within location	15.4%	18.8%	18.3%
	8	Count	10	25	35
		% within location	25.6%	13.1%	15.2%
Total		Count	39	191	230
		% within location	100.0%	100.0%	100.0%

age_cat * location Crosstabulation

			location		Total
			mound	village	
age_cat	0	Count	5	5	10
		% within age_cat	50.0%	50.0%	100.0%
	1	Count	1	22	23
		% within age_cat	4.3%	95.7%	100.0%
	2	Count	2	29	31
		% within age_cat	6.5%	93.5%	100.0%
	3	Count	3	15	18
		% within age_cat	16.7%	83.3%	100.0%
	4	Count	2	7	9
		% within age_cat	22.2%	77.8%	100.0%
	5	Count	1	6	7
		% within age_cat	14.3%	85.7%	100.0%
	6	Count	9	46	55
		% within age_cat	16.4%	83.6%	100.0%
	7	Count	6	36	42
		% within age_cat	14.3%	85.7%	100.0%
	8	Count	10	25	35
		% within age_cat	28.6%	71.4%	100.0%
Total		Count	39	191	230
		% within age_cat	17.0%	83.0%	100.0%

Logistic Regression

includes individuals of unknown age

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	230	100.0
	Missing Cases	0	.0
	Total	230	100.0
Unselected Cases		0	.0
Total		230	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
village	0
mound	1

Block 0: Beginning Block

Classification Table[a,b]

Observed			Predicted: site_location village	Predicted: site_location mound	Predicted: Percentage Correct
Step 0	site_location	village	191	0	100.0
		mound	39	0	.0
	Overall Percentage				83.0

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.589	.176	81.745	1	.000	.204

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	age_cat	.935	1	.333
		HEALTH_SCORE	1.660	1	.198
	Overall Statistics		3.536	2	.171

APPENDIX FOUR

CHI-SQUARE OUTPUT FROM SPSS

site_location * dental2 Crosstabulation

			dental2		
			poor	good	Total
site_location	village	Count	92	59	151
		Expected Count	93.9	57.1	151.0
		% within site_location	60.9%	39.1%	100.0%
	mound	Count	23	11	34
		Expected Count	21.1	12.9	34.0
		% within site_location	67.6%	32.4%	100.0%
Total		Count	115	70	185
		Expected Count	115.0	70.0	185.0
		% within site_location	62.2%	37.8%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.533[b]	1	.465		
Continuity Correction[a]	.285	1	.593		
Likelihood Ratio	.542	1	.462		
Fisher's Exact Test				.559	.299
Linear-by-Linear Association	.530	1	.467		
N of Valid Cases	185				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.86.

age_cat * dental2 Crosstabulation[a]

			dental2		Total
			poor	good	
age_cat	0	Count	4	1	5
		% within age_cat	80.0%	20.0%	100.0%
	2	Count	0	2	2
		% within age_cat	.0%	100.0%	100.0%
	3	Count	0	3	3
		% within age_cat	.0%	100.0%	100.0%
	4	Count	1	1	2
		% within age_cat	50.0%	50.0%	100.0%
	5	Count	1	0	1
		% within age_cat	100.0%	.0%	100.0%
	6	Count	7	1	8
		% within age_cat	87.5%	12.5%	100.0%
	7	Count	3	3	6
		% within age_cat	50.0%	50.0%	100.0%
	8	Count	7	0	7
		% within age_cat	100.0%	.0%	100.0%
Total		Count	23	11	34
		% within age_cat	67.6%	32.4%	100.0%

a. location = mound

age_cat * dental2 Crosstabulation[a]

			dental2		
			poor	good	Total
age_cat	0	Count	4	0	4
		% within age_cat	100.0%	.0%	100.0%
	1	Count	1	7	8
		% within age_cat	12.5%	87.5%	100.0%
	2	Count	1	22	23
		% within age_cat	4.3%	95.7%	100.0%
	3	Count	7	7	14
		% within age_cat	50.0%	50.0%	100.0%
	4	Count	1	6	7
		% within age_cat	14.3%	85.7%	100.0%
	5	Count	1	5	6
		% within age_cat	16.7%	83.3%	100.0%
	6	Count	22	11	33
		% within age_cat	66.7%	33.3%	100.0%
	7	Count	32	1	33
		% within age_cat	97.0%	3.0%	100.0%
	8	Count	23	0	23
		% within age_cat	100.0%	.0%	100.0%
Total		Count	92	59	151
		% within age_cat	60.9%	39.1%	100.0%

a. location = village

site_location * infection2 Crosstabulation

			infection2		
			poor	good	Total
site_location	village	Count	56	130	186
		Expected Count	52.9	133.1	186.0
		% within site_location	30.1%	69.9%	100.0%
	mound	Count	8	31	39
		Expected Count	11.1	27.9	39.0
		% within site_location	20.5%	79.5%	100.0%
Total		Count	64	161	225
		Expected Count	64.0	161.0	225.0
		% within site_location	28.4%	71.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.458[b]	1	.227		
Continuity Correction[a]	1.025	1	.311		
Likelihood Ratio	1.537	1	.215		
Fisher's Exact Test				.249	.156
Linear-by-Linear Association	1.452	1	.228		
N of Valid Cases	225				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.09.

site_location * hypoplasia2 Crosstabulation

			hypoplasia2		
			poor	good	Total
site_location	village	Count	74	76	150
		Expected Count	72.1	77.9	150.0
		% within site_location	49.3%	50.7%	100.0%
	mound	Count	14	19	33
		Expected Count	15.9	17.1	33.0
		% within site_location	42.4%	57.6%	100.0%
Total		Count	88	95	183
		Expected Count	88.0	95.0	183.0
		% within site_location	48.1%	51.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.517[b]	1	.472		
Continuity Correction[a]	.277	1	.598		
Likelihood Ratio	.519	1	.471		
Fisher's Exact Test				.565	.300
Linear-by-Linear Association	.514	1	.473		
N of Valid Cases	183				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.87.

site_location * crib_orb2 Crosstabulation

			crib_orb2		Total
			poor	good	
site_location	village	Count	30	85	115
		Expected Count	26.5	88.5	115.0
		% within site_location	26.1%	73.9%	100.0%
	mound	Count	2	22	24
		Expected Count	5.5	18.5	24.0
		% within site_location	8.3%	91.7%	100.0%
Total		Count	32	107	139
		Expected Count	32.0	107.0	139.0
		% within site_location	23.0%	77.0%	100.0%

Chi-Square Tests[d]

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	3.532[b]	1	.060	.066	.046	
Continuity Correction[a]	2.601	1	.107			
Likelihood Ratio	4.211	1	.040	.066	.046	
Fisher's Exact Test				.066	.046	
Linear-by-Linear Association	3.506[c]	1	.061	.066	.046	.036
N of Valid Cases	139					

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.53.

c. The standardized statistic is 1.872.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.

site_location * por_hyp2 Crosstabulation

			por_hyp2		Total
			poor	good	
site_location	village	Count	25	126	151
		Expected Count	20.3	130.7	151.0
		% within site_location	16.6%	83.4%	100.0%
	mound	Count	0	35	35
		Expected Count	4.7	30.3	35.0
		% within site_location	.0%	100.0%	100.0%
Total		Count	25	161	186
		Expected Count	25.0	161.0	186.0
		% within site_location	13.4%	86.6%	100.0%

Chi-Square Tests[d]

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	6.695[b]	1	.010	.010	.004	
Continuity Correction[a]	5.347	1	.021			
Likelihood Ratio	11.290	1	.001	.004	.004	
Fisher's Exact Test				.005	.004	
Linear-by-Linear Association	6.659[c]	1	.010	.010	.004	.004
N of Valid Cases	186					

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.70.

c. The standardized statistic is 2.580.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.

VITA

Juliette Vogel attended the University of North Carolina at Chapel Hill where, in 2004, she received her Bachelor of Arts degree in Anthropology with honors. Her interest in biological anthropology led her to the University of Tennessee's Anthropology Department, where she was accepted as a graduate student in 2004.

Ms. Vogel has interned at the North Carolina Office of the Chief Medical Examiner and has performed archaeological fieldwork in North Carolina, Tennessee, and Florida. She is currently employed at the University of Tennessee's Archaeological Research Laboratory.